

**CMS 30-Day All-Cause Hospital Readmission (ACR) Measure:
MIPS Performance Year 2017**

SAS Pack Software Documentation

**Submitted by Yale New Haven Health Services Corporation - Center for
Outcomes Research and Evaluation (YNHHSC/CORE)**

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1. Introduction

This document describes the details for implementing the performance year (PY) 2017 30-Day All-Cause Hospital Readmission (ACR) Measure SAS package (SAS pack) created to validate the Centers for Medicare & Medicaid Services (CMS) unplanned 30-day risk-standardized readmission rates calculated for eligible clinician groups and solo practitioners, as identified by their Medicare Taxpayer Identification Number (TIN).

This TIN-level, risk-standardized, all-cause unplanned readmission measure is adapted from a hospital-level quality measure (Horwitz et al. 2011) developed for the Centers for Medicare & Medicaid Services (CMS) by the Yale New Haven Health Services Corporation - Center for Outcomes Research & Evaluation (YNHHSC/CORE). This version of the measure is based on the measure updates developed for CMS by YNHHSC/CORE in 2018 with additional updates for new International Classification of Diseases (ICD)-10 Clinical Modification (CM) codes. The technical specifications for the measure are available at <https://www.cms.gov/Medicare/Quality-Payment-Program/Resource-Library/2018-Resources.html> under the Quality section. The following documents are available:

- *2018 MIPS Measure Information for the 30-Day All-Cause Hospital Readmission Measure*
- *2018 ACR Code Tables*

The PY 2017 ACR measure SAS pack is comprised of two SAS programs. Also needed are one SAS format file and one SAS dataset containing Condition Categories (CCs). There is one program for each condition and a separate program containing SAS macros called from the main program:

- all_cause_readmission_PY2017.sas
- all_cause_readmission_macros_PY2017.sas
- CC DXICDHCC.sas7bdat– one for International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9) and one for ICD-10 codes
- CCS Formats.sas7bcat –one for ICD-10 codes

The program is designed to be run with one year of data. They require specific datasets and formats as explained in [Section 3](#). This document provides examples of the input files and output datasets that can be expected once the program has run successfully.

2. System Requirements

The computer system needed to run the SAS pack should meet the following hardware and software basic requirements:

- Operating System: Microsoft Windows XP Professional or later versions and Linux
- Statistical Software: SAS 9.3.0 or later versions
- Hardware: minimum 2 GB RAM and minimum 50 GB hard drive space

3. Input Data Sources

The ACR Measure SAS pack utilizes pre-processed CMS administrative data to conduct analyses. The following data sources are used in the ACR Measure SAS pack:

- Index Hospital Discharge File – Includes:
 - Part A data for discharges selected for inclusion in the measure for the reporting year(s) and condition of interest
 - Demographic and Fee-for-Service (FFS) enrollment information from the Medicare Enrollment Database and Denominator file
- Post-Index Hospital Discharge File – Includes:
 - Records of subsequent admissions for patients in the index discharge file
 - Part A discharge data for admissions that occurred within 365 days after the index discharge date
- Diagnosis History File – Includes:
 - Records for patients with index admissions
 - Diagnosis codes selected for 365 days prior to index admission
 - Diagnoses from Part A Inpatient and Hospital Outpatient Data
 - Source code, which indicates the source file from which the diagnosis code was extracted
- Attribution File – Includes:
 - Records linking Medicare beneficiaries to the TIN that provided more primary care services, as measured by allowed charges, during 2017 than any other TIN

3.1 Index File

The variable names, data formats, and data structures in each input file must match the data standards described in the data specifications. The record unit for the Index Discharge file is at the patient discharge. Display 1 shows the SAS file data structure for the index inpatient discharge file.

Display 1. Variables and Attributes of the Index Hospital Discharge File

Variable	Type	Length	Label
ADMMO	Num	8	
BEGIN	Num	8	
BEGIN0	Num	8	
BENE_EQTBL_BIC_HICN_NUM	Char	11	BENE_EQTBL_BIC_HICN_NUM
DISMO	Num	8	
FLAG_UNEQUAL	Num	8	
FLAG_UNEQUAL_A	Num	8	
FRSTDAY	Num	8	
GROUP	Num	8	TRANSFER BUNDLE INDICATOR
HISTORY_CASE	Num	8	REVISED CASE NUMBER FOR MERGING INDEX AND HISTORY FILES
PARA	Num	8	PART A FFS ENROLLEE AT ADMISSION
PARA_B	Num	8	PART A AND B FFS ENROLLEE AT ADMISSION
PART_A_BUYIN_2014- PART_A_BUYIN_2017	Char	12	PART A BUYIN FLAGS 2014-2017
PART_A_HMO_2014- PART_A_HMO_2017	Char	12	PART A HMO FLAGS 2014-2017
PART_B_BUYIN_2014- PART_B_BUYIN_2017	Char	12	PART B BUYIN FLAGS 2014-2017
PART_B_HMO_2014- PART_B_HMO_2017	Char	12	PART B HMO 2014-2017
POST	Num	8	
POSTD	Num	8	
POSTMO	Num	8	POST-ADMISSION COMPLETENESS INDICATOR
POSTMOD	Num	8	POST-DISCHARGE COMPLETENES INDICATOR
POSTMOD_A	Num	8	POST-DISCHARGE COMPLETENES INDICATOR - PTA Only
POSTMO_A	Num	8	POST-ADMISSION COMPLETENESS INDICATOR - PTA Only
POST_FLAG	Num	8	Flag for transfers out at end of period
PREMO	Num	8	PRE-ADMISSION COMPLETENESS INDICATOR
PREMO_A	Num	8	PRE-ADMISSION COMPLETENESS INDICATOR - PTA ONLY
PROC1-PROC25	Char	7	CLM_PRCDR_CD(1-25): Claim Procedure Code
PROCDT1-PROCDT25	Num	8	CLM_PRCDR_PRFRM_DT(1-25): Claim Procedure Performed Date
PSTATE	Char	20	MEDICARE PROVIDER STATE CODE
TRANS	Num	8	1=STAY IS PART OF A TRANSFER CHAIN
TRANS_FIRST	Num	8	FIRST STAY IN A TRANSFER CHAIN
TRANS_LAST	Num	8	LAST STAY IN A TRANSFER CHAIN
TRANS_MID	Num	8	MIDDLE STAY IN A TRANSFER CHAIN
UNRELDMG	Num	8	UNRELIABLE AGE/GENDER INDICATOR
UNRELDTH	Num	8	UNRELIABLE DEATH INDICATOR
YEAR	Char	4	YEAR COHORT BASED ON DISCHARGE DATE
ADMSN_DT	Num	8	ADMISSION DATE
ASTH	Num	8	FINAL FLAG FOR CHRONIC CONDITION ASTH (ASTHMA)
BENE_DOB	Num	8	BENE_DOB
BENE_FIRST_NAME	Char	30	BENE_FIRST_NAME
BENE_LAST_NAME	Char	40	BENE_LAST_NAME
BENE_SK	Num	8	BENE_SK

Variable	Type	Length	Label
BID_MPR_3	Char	11	BENE_SK: BENEFICIARY IDENTIFICATION NUMBER
BIRTH	Num	8	DATE OF BIRTH
BUYIN_DEATH_MOD	Num	8	BUYIN_DEATH_MOD
CASE	Num	8	INDEX CASE NUMBER WITH TRANSFERS CONSECUTIVELY NUMBERED
CHF	Num	8	FINAL FLAG FOR CHRONIC CONDITION CHF (HEART FAILURE)
CHF_2016	Num	8	FLAG FOR CHRONIC CONDITION CHF (HEART FAILURE) BASED ON 2016 CLAIMS
CHF_2017	Num	8	FLAG FOR CHRONIC CONDITION CHF (HEART FAILURE) BASED ON 2017 CLAIMS
CLM_DGNS_PRCDR_ICD_IND	Char	1	CLM_DGNS_PRCDR_ICD_IND: THIS IS THE CLAIM PROD VERSION CODE WHICH IS SPACES OR 9 FOR ICD 9 AND 0 FOR ICD 10
COPD	Num	8	FINAL FLAG FOR CHRONIC CONDITION COPD
COUNTER	Num	8	
COUNTER600	Num	8	
DDEST	Num	8	DISCHARGE DESTINATION CODE
DEATH	Num	8	DATE OF DEATH
DEATH_DT	Num	8	DEATH_DT
DIA	Num	8	FINAL FLAG FOR CHRONIC CONDITION DIA (DIABETES)
DIA_2016	Num	8	FINAL FLAG FOR CHRONIC CONDITION DIA (DIABETES) BASED ON 2016 CLAIMS
DIA_2017	Num	8	FINAL FLAG FOR CHRONIC CONDITION DIA (DIABETES) BASED ON 2017 CLAIMS
DIAG1-DIAG25	Char	7	CLM_DGNS_CD(1-25): CLAIM DIAGNOSIS CODE
DIED_17	Num	8	DIED_17
DSCHRGDT	Num	8	DISCHARGE DATE
EDGNSD01-EDGNSD12	Char	7	CLM_DGNS_E_CD(01-12): CLAIM DIAGNOSIS E CODE
ESRD_IND_2014-ESRD_IND_2017	Char	1	
HICAN	Char	11	HICAN
I	Num	8	
IHD	Num	8	FINAL FLAG FOR CHRONIC CONDITION IHD (CORONARY ARTERY DISEASE)
IHD_2016	Num	8	FINAL FLAG FOR CHRONIC CONDITION IHD (CORONARY ARTERY DISEASE) BASED ON 2016 CLAIMS
IHD_2017	Num	8	FINAL FLAG FOR CHRONIC CONDITION IHD (CORONARY ARTERY DISEASE) BASED ON 2017 CLAIMS
NUM_COND	Num	8	NUMBER OF CHRONIC CONDITIONS FOR THE BENEFICIARY
PRE_CCW_DENOM_ONLY	Num	8	PRE_CCW_DENOM_ONLY
QA_CHECK600	Num	8	
SEX	Char	1	BENEFICIARY SEX FROM EDB
SHORT_STAY	Num	8	FLAG INDICATING A SHORT STAY HOSPITAL
STAYID	Num	8	UNIQUE IDENTIFIER FOR A STAY (MULTIPLE CLAIMS)
STAYSEQ	Num	8	SEQUENCE OF CLAIMS WITHIN A STAY SERIES (I.E. STAYID)
STUS_CD	Char	2	PTNT_DSCHRG_STUS_CD: PATIENT DISCHARGE STATUS CODE
TRANS_FIRSTLASTMID	Num	8	
TXFLAG	Num	8	1=TRANSFER, 1=DIED, 0=OTHERWISE
V_DOD_SW	Char	1	V_DOD_SW

3.2 Post-Index Hospital Discharge File

In order to determine whether a readmission took place, the ACR Measure SAS pack requires inpatient claims data for up to 30 days after the index discharge date. This information is captured in a separate file that contains information similar to the Index Discharge file, although with fewer fields. The file includes inpatient claims for up to 90 days after discharge, but the software chooses those within 30 days to create the

outcome indicator. Display 2 shows the SAS file structure of the Post-Index file. This file can be linked to the Index Discharge file by HIC number and CASE identifier.

Display 2. Variables and Attributes of the Post-Index Hospital Discharge File

Variable	Type	Len	Label
ADMDIFF	Num	8	DAYS BETWEEN INDEX DISCHARGE AND POST INDEX ADMISSION
ADMDT1-ADMDT71	Num	8	ADMISSION DATE #1-#71
CASE	Num	8	CASE NUMBER FROM INDEX EVENT RECORD
DISDT1-DISDT71	Num	8	DISCHARGE DATE #1-#71
I	Num	8	
LOS	Num	8	LENGTH OF STAY
PROC1-PROC25	Char	7	PROCEDURE CODE #1-#25
PROCDT1-PROCDT25	Num	8	PROCEDURE DATE #1-#25
PROVID1-PROVID71	Char	20	PROVIDER ID #1-#71
ADMSN_DT	Num	8	DATE OF ADMISSION
BID_MPR_3	Char	11	BENE_SK: Beneficiary Identification Number
CLM_DGNS_PRCDR_ICD_IND	Char	1	CLM_DGNS_PRCDR_ICD_IND: This is the Claim Prod Version code which is spaces or 9 for ICD 9 and 0 for ICD 10
DDEST	Num	8	DISCHARGE DESTINATION CODE
DIAG1-DIAG25	Char	7	DIAGNOSIS Code #1-#25
DSCHRGDT	Num	8	DATE OF DISCHARGE
EDGNSD01-EDGNSD12	Char	7	CLM_DGNS_E_CD(01-12): Claim Diagnosis E Code
POST_QA_CHECK	Num	8	
POSTCOUNTER	Num	8	
SHORT_STAY	Num	8	Flag indicating a short stay hospital
STAYID	Num	8	Unique identifier for a stay (multiple claims)
STAYSEQ	Num	8	Sequence of claims within a stay series (i.e. stayid)
STUS_CD	Char	2	PTNT_DSCHRG_STUS_CD: Patient Discharge Status Code
TRANSDSUBSET	Num	8	
TXFLAG	Num	8	

3.3 Diagnosis History Files

The Diagnosis History file is used to assign comorbidities for risk adjustment, based on 12 months of claims history for the patients in the index file. These files are at the diagnosis/procedure date level and can be linked back to the index file by HICNO and CASE number by using the HICNO and HISTORY_CASE on the index file. The SOURCE field is used to determine what data repository the information came from. Display 3 shows the file layout for the diagnosis history file.

Display 3. Variables and Attributes of the Diagnosis History File

Variable	Type	Len	Label
CASE	Num	8	CASE NUMBER MARKER
DIAG	Char	7	DIAGNOSIS CODE
FDATE	Num	8	ADMISSION DT (IP)
SOURCE	Char	7	4 DIGIT SOURCE CODE
TDATE	Num	8	DISCHARGE DT (IP)
VRSN	Char	1	CLMS_DGNS_PRCDR_ICD_IND: THIS IS THE CLAIM PROD VERSION CODE WHICH IS SPACES OR 9 FOR ICD 9 OR 0 FOR ICD 10
BID_MPR_3	Char	11	BENE_SK: BENEFICIARY IDENTIFICATION NUMBER

3.4 Attribution File

The Attribution file associates each beneficiary with a TIN based on the amount of primary care services that the beneficiary received in 2017, as measured by allowed charges. The ACR measure is computed for each TIN using the set of patients attributed to the TIN. Display 4 shows the file layout for the Attribution file.

Display 4. Variables and Attributes of the Attribution File

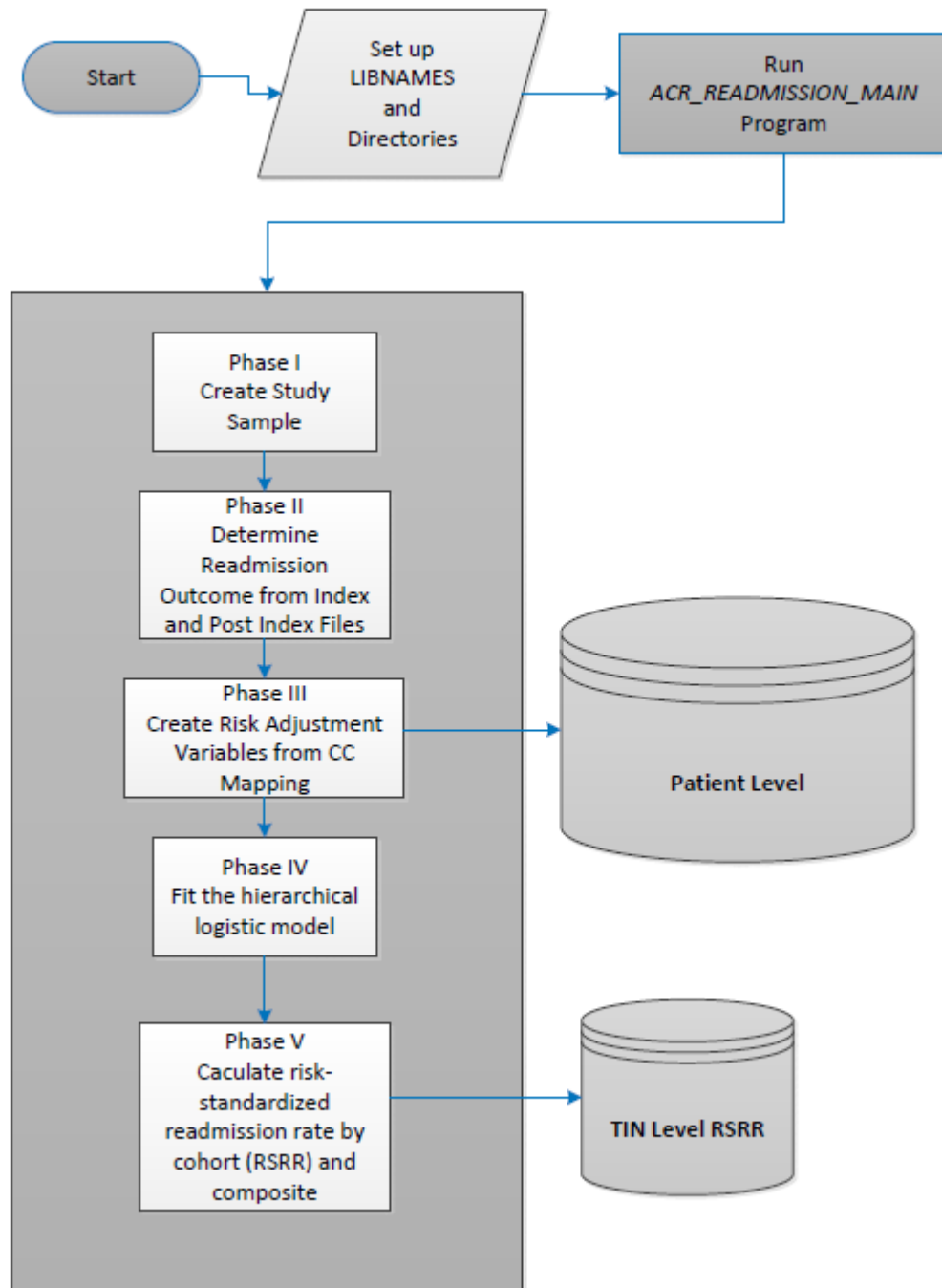
Variable	Type	Len	Label
ATTRIB_STEP	Num	4	STEP BY WHICH BENEFICIARY WAS ATTRIBUTED TO TIN: 1 OR 2
BENE_SK	Num	8	IDR BENEFICIARY ID
TIEBREAK1	Num	8	EQUALS 1 IF TIE FOR PLURALITY OF ALLOWED CHARGES FOR PRIMARY CARE SERVICES
TIEBREAK2	Num	8	EQUALS 1 IF TIE FOR MOST RECENT DATE OF SERVICE
TIN_ASSIGNED	Char	10	GROUP OR INDIVIDUAL TIN TO WHICH THE BENEFICIARY IS ATTRIBUTED
BID_MPR_3	CHAR	11	BID_MPR_3

4. SAS Pack Structure

See [Figure 1](#) for a flow chart displaying an overview of the programs. The user can edit the SAS code of the first section of the SAS program. The user can modify the file directories that contain the input datasets, the SAS format files for Condition Category (CC) mapping and Agency for Healthcare Research and Quality (AHRQ) Clinical Classifications Software (CCS) mapping, as well as the location of the datasets to be stored. The CC mapping is maintained by RTI International. An Excel version of the map can be found on www.qualitynet.org under the Hospitals-Inpatient > Claims-Based Measures > Readmission Measures > Resources section. The AHRQ CCS map description can be obtained from the following website: <https://www.hcup-us.ahrq.gov/toolssoftware/ccs10/ccs10.jsp>.

The next section of the SAS Pack is used for the derivation of the cohort and for the determination of the outcomes. The final dataset is used for the model development. The next section of the code is used to run the cohort data through the hierarchical model to create TIN-level results. These results are then used to create the TIN-level risk-standardized readmission rates (RSRRs) and composite ACR measure. The output is a SAS dataset called ACR_RSRR which has all cohort-level and composite measures at the TIN-level.

Figure 1. SAS Process Flow Chart



5. Output Data

The SAS pack creates four permanent output files in SAS dataset format. These files will be written to the directory the user designates in the first section of the program. The files are as follows:

1. Final master dataset – Patient Level (ACR_readm_all.sas7bdat)
2. Final study sample – Patient Level (ACR_readm_analysis.sas7bdat)
3. TIN-Level RSRR (ACR_readm_rsrr.sas7bdat)
4. Bootstrap results (ACR_readm_rsrr_bs.sas7bdat)¹

The final master dataset contains all admissions in the original cohorts along with the inclusion/exclusion indicators assigned in the program. The final study sample file contains all risk adjustment variables and the readmission indicators for admissions that are included in the measure calculation. The unit of measure for this file is at the hospital discharge level. The final study sample file is further used as the primary data source for conducting the model analyses and the bootstrapping simulation. Display 5 shows a portion of this file. Please refer to the actual SAS programs to learn how the risk adjustment variables were defined.

¹ The bootstrap results output file is not used for the TIN-level version of the All-Cause Readmission measure.

Display 5. A Section of Output File (ACR_Readm_Analysis)

RADM30	Cohort	Severe Infection (CC 1, 3-5)	Metastatic cancer/acute leukemia (CC 7)	Severe Cancer (CC 8, 9)	Diabetes mellitus (CC 15-20, 119, 120)	End-stage liver disease (CC 25, 26)
0	CARDIORESPIRATORY	0	0	0	0	0
1	MEDICINE	0	0	0	0	0
0	NEUROLOGY	0	0	0	0	0
0	MEDICINE	0	0	0	0	0
0	SURGICAL	0	0	0	0	0
0	SURGICAL	0	0	0	1	0
0	MEDICINE	0	0	0	0	0
0	CARDIORESPIRATORY	0	0	0	0	0
0	SURGICAL	0	0	0	0	0
0	SURGICAL	0	0	0	0	0
0	CARDIORESPIRATORY	0	0	0	0	0
0	NEUROLOGY	0	0	0	0	0
0	NEUROLOGY	0	0	0	0	0
0	MEDICINE	0	0	0	0	0
0	MEDICINE	0	0	0	1	0
0	SURGICAL	0	0	0	0	0
0	MEDICINE	0	0	0	0	0
0	MEDICINE	0	0	0	0	0
0	CV	0	0	0	1	0
0	CARDIORESPIRATORY	0	0	0	0	0
0	MEDICINE	0	0	0	0	0
0	MEDICINE	0	0	0	0	0
0	SURGICAL	0	0	0	1	0
0	MEDICINE	0	0	0	0	0
0	MEDICINE	0	0	0	0	0
0	SURGICAL	0	0	0	0	0
0	MEDICINE	0	0	0	0	0
0	MEDICINE	0	0	0	0	0
0	SURGICAL	0	0	0	1	0
0	SURGICAL	0	0	0	0	0
0	MEDICINE	0	0	0	0	0
0	CARDIORESPIRATORY	0	0	0	0	0
1	MEDICINE	0	0	0	0	0

The TIN-Level RSRR file includes the TIN identifier, total number of cases (volume), observed readmission rate (OBS), predicted readmission rate (PRED), expected readmission rate (EXP), risk-standardized readmission ratio (SRR), and risk-standardized readmission rate (RSRR) as shown in Display 6. The data contained in this file is at the TIN level and provides the point estimates of the readmission rate for each TIN.

Display 6. A Section of TIN-Level Output File (ACR_Readm_Rsrr)

Medicare provider number	VOLUME	READMISSION	READM_PLAN	OBS_MED	RADM30_MED	RADM30P_MED	SRR_MED	RSRR_MED	VOLUME_MED	OBS_SURG	RADM30_SURG
	5309	760	57	0.1620635748	311	20	0.9960766014	0.167783127	1919	0.103268945	139
	2790	415	35	0.1529503106	197	17	0.9948780459	0.1675812376	1288	0.1162790698	55
	4068	606	52	0.1578947368	255	17	0.9928517593	0.1672399217	1615	0.1118335501	86
	502	72	2	0.147601476	40	2	1.0317691652	0.1737953253	271	0.1	4
	135	10	0	0.0930232558	8	0	0.9614984402	0.1619586433	86	0	0
	2688	351	31	0.1580063627	149	9	0.9942037239	0.1674676521	943	0.0977835724	75
	830	126	7	0.1466346154	61	5	1.0065208439	0.169542397	416	0.1071428571	9
	2444	340	27	0.1444906445	139	15	0.9050166706	0.1524446281	962	0.125	75
	24	1	1	0.3333333333	1	0	1.0107067982	0.1702474959	3	0	0
	2032	305	17	0.182983683	157	9	1.1213624832	0.1888867821	858	0.085106383	40
	380	50	3	0.1277777778	23	2	0.9160433553	0.1543020069	180	0.18	9
	203	31	1	0.2095238095	22	1	1.0623969965	0.1789543997	105	0.2	1
	3136	480	40	0.1843575419	165	11	1.0384041272	0.1749129448	895	0.1153136531	125
	3214	447	32	0.1600633914	202	14	0.9475826402	0.1596146102	1262	0.0997679814	86
	383	45	2	0.1144278607	23	1	0.9100750504	0.1532966818	201	0.027027027	1
	3900	542	58	0.1539923954	243	25	0.9779682074	0.1647328767	1578	0.1050620821	110
	137	19	2	0.1692307692	11	2	1.0244795764	0.1725674378	65	0	0
	5949	1015	87	0.2131661442	408	34	1.1048226349	0.1861007439	1914	0.1464943204	374
	445	59	5	0.1352459016	33	4	0.9698749634	0.1633696183	244	0.2	5
	2183	315	23	0.1570482498	166	10	0.9875610974	0.1663487415	1057	0.0798004988	32
	1039	160	9	0.1559633028	68	5	0.9938791345	0.1674129769	436	0.1134020619	22
	905	133	12	0.1510791367	63	5	0.9958053478	0.167737436	417	0.0776699029	8
	10681	1441	126	0.1576502732	577	38	0.9384287518	0.1580726927	3660	0.0976995172	344
	3366	553	36	0.1805243446	241	12	1.0797198585	0.1818723318	1335	0.1405472637	113
	199	20	4	0.099009901	10	3	0.9351139319	0.1575143312	101	0.3333333333	1
	385	69	2	0.1734693878	34	1	1.0160724029	0.1711512998	196	0	0

6. SAS Pack Usage

The following steps outline the procedures for running the ACR Measure SAS pack:

1. Specify the file directories for where the input resides and where the output will be placed, including the CC map and the AHRQ CCS format library location.
2. Add the input file names and result file names in all_cause_readmission_PY2017.SAS (use the library prefix you created if you wish to save the files).
3. Run Program all_cause_readmission_PY2017.SAS.