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## I. INTRODUCTION TO THE HCBS MEASURE CALCULATION PACKAGE

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This measure calculation package (MCP) provides the SAS programs Mathematica Policy Research (Mathematica) used to produce the HCBS composite and pressure ulcer measures. Details on the measure development process, including measure specifications and methods for risk adjustment, can be found at the Money Follows the Person (MFP) website:

<http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Long-Term-Services-and-Supports/Balancing/Money-Follows-the-Person.html>

The purpose of the MCP is to allow users to calculate risk-adjusted HCBS composite and pressure ulcer measures for HCBS users. In addition, the SAS code included in the MCP may provide more detail on methods than is available in the reports.

Chapter 2 describes the data sources and key data elements needed to run these programs. The MCP assumes that the end user has access to the requisite data on HCBS user population. This includes information on HCBS use and enrollment, Medicare eligibility, hospice use, demographics, risk factors, and Medicare- and Medicaid-paid inpatient claims.

In Chapter 3, the MCP goes on to describe the SAS programs to calculate the HCBS composite and pressure ulcer measures. One set of SAS programs calculates the HCBS composites and the pressure ulcer measure. There are four main programs to calculate the measures, as well as auxiliary programs that define macros and formats. The following four programs are run sequentially to calculate observed and risk-adjusted state-level HCBS composite and pressure ulcer rates:

1. **01\_Prep\_Denominator.sas** cleans and formats the HCBS user-level data.
2. **02\_HCBS\_PQI\_Input.sas** cleans and formats the Medicare and Medicaid inpatient claims data.
3. **03\_HCBS\_PQSAS1.sas** identifies inpatient claims that meet the HCBS composite or pressure ulcer inclusion criteria.
4. **04\_RISK\_ADJUST.sas** produces state-level observed and risk-adjusted HCBS composite and pressure ulcer rates.

The risk-adjusted rates are calculated using the 2010 HCBS fee-for-service (FFS) population as a reference population. The benefit of a reference population is that an end user with information on a subset of state may calculate risk-adjusted rates. The downside of a reference population is that the risk-adjusted rates are interpreted as the rate of performance relative to the average HCBS FFS user's experience in 2010; the data, coding standards, and relationship between risk factors and the measures may change over time, and therefore, the reference population should be updated whenever possible. For users interested in refitting risk-adjustment models, we encourage them to read the HCBS composite and pressure ulcer reports on the MFP website listed above.

These programs were written by Mathematica but are based on work and programs from the Agency for Healthcare Research and Quality (AHRQ). As a starting point, we replicated the specifications set forth in AHRQ's HCBS QI Technical Report by Schultz et al. (2012).<sup>1</sup> In addition, we modified version 4.4 of AHRQ's Prevention Quality Indicator (PQI) SAS programs to create the 03\_HCBS\_PQSAS1.sas programs.

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<sup>1</sup> Schultz et al. 2012. "Development of Quality Indicators for Home and Community-Based Services Population: Technical Report." Available at: [http://www.qualityindicators.ahrq.gov/Downloads/Resources/Publications/2012/HCBS\\_QI\\_Technical\\_Report.pdf](http://www.qualityindicators.ahrq.gov/Downloads/Resources/Publications/2012/HCBS_QI_Technical_Report.pdf)

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## II. BUILDING THE ANALYTIC FILES

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There are two sets of analytic files required to calculate the HCBS composites and pressure ulcer measures. First, the user needs a person-level dataset that identifies Medicaid beneficiaries using HCBS services either through a 1915(c) waiver or state plan, or enrolled in a 1915(c) waiver. This includes persons only enrolled in Medicaid, as well as HCBS users who are Medicare-Medicaid eligible. Second, the user needs inpatient claims for Medicare- and Medicaid-paid acute care hospitalizations. The following instructions outline the construction of needed analytic files using calendar year 2010 data.

The specifications to define the HCBS population were derived from AHRQ's specifications. Detailed instructions on defining this population are available in the HCBS QI technical report (Schultz et al. 2012) and in Appendix A of the Proposed Methods for Developing and Testing Risk- and Reliability-Adjustment Models for HCBS Composite Measures (Bohl et al. 2015).<sup>2</sup>

### A. Data sources

To first establish the baseline group of Medicaid beneficiaries (including Medicaid-only beneficiaries and Medicare-Medicaid eligible (MME)) using HCBS services, we used the Medicaid administrative data from the Medicaid Analytic eXtract (MAX) data files, which contain person-level records of Medicaid enrollment and service use. To identify HCBS users, we used both indicators of enrollment in HCBS 1915(c) waivers from the MAX Person Summary (PS) file and receipt of HCBS under either a 1915(c) waiver or through the state plan from the MAX Other (OT) files. The 2010 MAX PS file was merged with Medicare enrollment data from the Master Beneficiary Summary File (MBSF). The MBSF is used to identify MMEs and Medicare managed care enrollment.

Record of Medicare- and Medicaid-paid hospice is required for the Pressure Ulcer measure. We identified hospice claims through the MAX OT file, as well as the Medicare Hospice file. For each HCBS user, we identified the first and last day of hospice service in calendar year 2010 using the service dates on hospice claims. Hospice claims are not needed for users only interested in the HCBS composites.

### B. Defining the HCBS population

We identified HCBS users enrolled in or using HCBS waivers or HCBS state plan services. This includes persons only enrolled in Medicaid, as well as HCBS users who are MME. Enrollment in an HCBS 1915(c) waiver was defined as at least one month of enrollment in the following waivers: aged/disabled, aged only, disabled only, traumatic brain injury, HIV/AIDS, mentally retarded/developmentally disabled, mental illness, technologically dependent, an

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<sup>2</sup> Bohl et al. 2015. "Proposed Methods for Developing and Testing Risk- and Reliability-Adjustment Models for HCBS Composite Measures." Available at: <http://www.medicaid.gov/medicaid-chip-program-information/by-topics/long-term-services-and-supports/balancing/money-follows-the-person.html>

unspecified waiver, or autism.<sup>3</sup> Use of HCBS under a 1915(c) waiver was defined as at least one month of claims for personal care, at-home private duty nursing, adult day, home health of at least 90 days, residential care, at-home hospice, rehabilitation, case management, transportation, or durable medical equipment. Use of HCBS via the state plan was defined as at least one month of claims for personal care, at-home private duty nursing, adult day, home health of at least 90 days, residential care, or at-home hospice. The restriction requiring at least three consecutive months (90 days) of home health use is designed to eliminate those whose home health care is for rehabilitation purposes.

### **C. Exclusions**

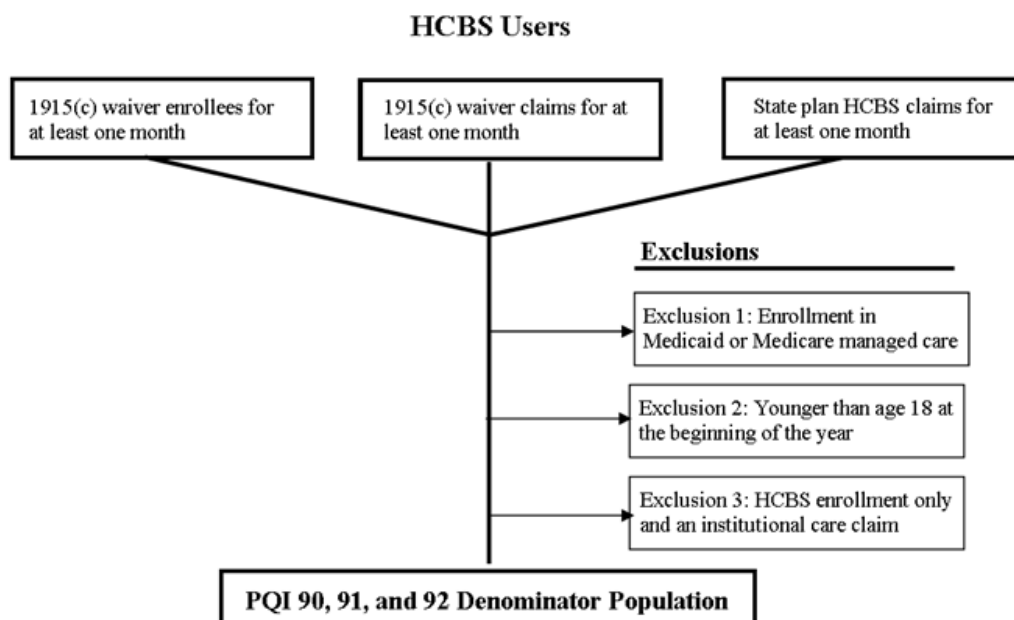
We imposed several important exclusions, in accordance with the specifications developed by AHRQ (Figure II.1). We excluded both Medicaid managed care and Medicare Advantage enrollees (Exclusion 1) because their claims were either not available or not comparable to those for beneficiaries in the fee-for-service system. To exclude Medicaid managed care enrollees, we used the MAX PS file to identify individuals enrolled in either a medical or comprehensive managed care plan, a long-term care managed care plan, or a Program of All-Inclusive Care for the Elderly program. In turn, we determined enrollment in Medicare Advantage using the monthly managed care flags available in the Medicare MBSF. In both cases, if at least one month of managed care enrollment was identified during the period of interest, the individual was excluded from the measure denominator.

We also excluded children by limiting the eligible population to people 18 or older (Exclusion 2). We wanted to exclude this group because they are a population with substantially different care needs and propensity of potentially preventable hospitalizations than adult HCBS users. Using the MAX PS file, we removed HCBS users who were younger than 18 at the start of the period of interest (for example, January 1, 2010, for the 2010 HCBS population).

Finally, people with a record of HCBS enrollment only (that is, no observed HCBS claims) who also had a record of institutional long-term care claims were excluded (Exclusion 3). We identified individuals who qualified as HCBS users only because they had at least one month of 1915(c) enrollment, but no 1915(c) or state plan HCBS claims, using the MAX PS and OT files, respectively. Then, if these individuals had at least one month with an institutional long-term care claim (that is, nursing home, intermediate care facilities for people with intellectual disabilities, or mental institution), they were excluded from the denominator population.

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<sup>3</sup> The autism waiver was introduced after AHRQ's initial work to develop the HCBS measures was completed. Mathematica included these HCBS waivers in the standard definition of an HCBS user, however use of the autism waiver is generally restricted to children, who are not eligible for the measure denominators.

**Figure II.1. Defining the measure denominator**

Source: Adapted from Schultz et al. 2012. "Development of Quality Indicators for Home and Community-Based Services Population: Technical Report." Available at: [http://www.qualityindicators.ahrq.gov/Downloads/Resources/Publications/2012/HCBS\\_QI\\_Technical\\_Report.pdf](http://www.qualityindicators.ahrq.gov/Downloads/Resources/Publications/2012/HCBS_QI_Technical_Report.pdf).

#### **D. Person-level analytic file**

Table II.1 describes the variables needed in the analytic file. These variables, at a minimum, are needed to run the HCBS software. The table shows the variable name, a brief description, its utility, and the source. All of these specifications are based on the data available from 2010.

Of note, the Chronic Conditions Warehouse (CCW) data are used to identify risk factors. The CCW flags are available through CMS data systems or through a data request to the CCW website. As of this publication, some of the mental health conditions and substance use disorders were unavailable through CMS data systems, but we constructed them according to the specifications in Appendix C of the HCBS Composite Risk-Adjustment Volume 1 report (Bohl et al. 2015b).<sup>4</sup>

<sup>4</sup> Bohl et al 2015b. "Risk Adjustment of HCBS Composite Measures, Volume 1." Available at: <http://www.medicaid.gov/medicaid-chip-program-information/by-topics/long-term-services-and-supports/balancing/money-follows-the-person.html>.

**Table II.1. Analytic file specifications for the person-level HCBS user file**

Variable	Description	Purpose	Source
MSIS_ID	Medicaid ID	Medicaid ID to link individuals to the MAX IP file	MAX PS
MAX_STATE	State or Medicaid eligibility	Used in conjunction with MSIS ID as a unique identifier. Also used to report final rates	MAX PS
HICNO	Medicare HIC number	Used to link records to MedPAR	MAX PS
CALENDAR_YEAR	Calendar year represented in the HCBS population	Used to map monthly flags to calendar dates on claims	User input
A_AGE	Age at the beginning of a calendar year	Risk adjustment	MAX PS
A_FEMALE	Gender	Risk adjustment	MAX PS
A_DUAL	MME status	Dual-eligibility indicator. Used to stratify results	MAX PS
A_RACE	Race/ethnicity of HCBS user	This is not essential to the software. It is retained in case the user wants to stratify results	MAX PS
HCBS_TIME	Months of HCBS use or enrollment in the calendar year	Defines the denominator for the HCBS composite observed rates	MAX PS and OT  User constructed from waiver enrollment and use and state plan HCBS flags
HCBS_TIME_PRU	Months of HCBS use or enrollment in the calendar year, less months of hospice use	Defines the denominator for the HCBS pressure ulcer observed rates	MAX PS and OT.  User constructed from waiver enrollment and use flags, and state plan flags
HCBS_TIME_FLAG_1 - HCBS_TIME_FLAG_12 HCBS_USER_1- HCBS_USER_12 MAX_HCBS_ENROLL_1- MAX_HCBS_ENROLL_12	Monthly flags of HCBS enrollment/use (HCBS_TIME_FLAG), HCBS use (HCBS_USER), or HCBS enrollment (MAX_HCBS_ENROLL)	Used to identify inpatient records occurring during HCBS enrollment and use. Also used to define the HCBS_TIME and HCBS_TIME_PRU variables	MAX PS and OT. User constructed from waiver enrollment and use flags, and state plan flags
EL_MDCR_DUAL_MO_1 - 12	Monthly flags indicating Medicare eligibility	Used to search for MedPAR (Medicare-paid) inpatient claims	MAX PS
HOSPICE_START HOSPICE_END	First and last date of hospice claims in the calendar year	Used to restrict the pressure ulcer numerator and denominator (HCBS_TIME_PRU).	MAX OT (Medicaid-paid hospice) and Medicare Hospice files
ACP ANXI BIPL DEPSN PSDS PTRS SCHI SCHIOT TOBA ASD CP CF EPLPSY ID LD MOBIMP MS MDYS ODD DEAF BLIND SPINA SCI TBI ALCO SUBS HYPHTY AMI ALZ ALZRDS ANEMIA ASTHMA AFIB HYPPLA CAT CKD COPD DEPR DIAB GLCM CHF HFRAC HYPLIP HYPHTEN IHD OST RA STRK BRC CRC PRC LNGC ENDC	Chronic condition, disability, mental health, and substance use disorder flags  Flags represent history of this risk factor as of the first day of the calendar year under analysis	Used as risk-adjustment variables	The Chronic Conditions Warehouse

**E. Inpatient claims**

To identify hospital admissions meeting the inclusion criteria for the HCBS composite and pressure ulcer measure, the user needs Medicare- and Medicaid-paid inpatient hospital claims. For Medicare-paid hospitalizations, we used inpatient claims from the calendar year 2010 Medicare Provider Analysis and Review (MedPAR) file. For Medicaid-paid hospitalizations, we used calendar year 2010 hospitalizations from the MAX Inpatient (IP) file. Before running the SAS programs, we restricted the files to records for those in the HCBS analytic file described above.

### III. RUNNING THE SAS PROGRAMS

The user must download and unzip all SAS programs and auxiliary files in the MCP (Table III.1). These programs were written for a Windows environment using SAS version 9.4. Because of the large files being processed by through these programs, it may take multiple hours to process.

**Table III.1. Files included in the MCP**

File name	Type
01_Prep_Denominator.sas	Primary
02_HCBS_PQI_Input.sas	Primary
03_HCBS_PQSAS1.sas	Primary
04_RISK_ADJUST.sas	Primary
CONTROL.sas	Auxiliary program for all primary programs. Also defines macros for 01_Prep_Denominator.sas and 02_HCBS_PQI_INPUT.sas
OVERLAP.sas	Auxiliary program defining macros for 03_HCBS_PQSAS1.sas
Formats.sas7bcat	Auxiliary program defining formats, such as the ICD-9 codes used to define the acute and chronic composite.
Params_## and zero_paramest_## SAS datasets.	There are 10 SAS data files with risk-adjustment coefficients for the acute composite (## = 91), chronic composite (## = 92), and pressure ulcer (## = 93) measures. There are separate files for duals (A_DUAL = 1) and Medicaid-only (A_DUAL=0) HCBS users. The acute and chronic composites have two coefficient files: one for the zero component (zero_paramest) and another for the count component (params)

#### Steps for running the programs

- 1) Modify the CONTROL.sas program

The user must modify the macros in lines 5 through 17. These macros specify the calendar year, number of years in the data, sets of monthly variables, and the number of diagnosis and procedure codes to use on claims. Of note—only 9 diagnoses (NDX) and 6 procedures (NPR) are used because, as of 2010, only this number of variables were retained in the MedPAR and MAX IP files. This program is never run directly—other programs use this program.

**Purpose:** Define macros and pathways

**Input file:** None

**Output file:** None



2) Modify and run the 01\_Prep\_Denominator.sas program

Before this program is run, the user must update the file pathways and names in lines 14-23.

**Purpose:** Format variables in the HCBS analytic file and output the final denominator file.

**Input:** Person-level file (HCBS\_ANALYTIC\_FILE) with HCBS users described in chapter 2.

**Output:** HCBS\_PQI\_DENOM, used to define the denominator.

**Support program:** CONTROL.sas

3) Modify and run the 02\_HCBS\_PQI\_Input.sas program. Before running this program, the user must update the file names and pathways in lines 21 to 33.

**Purpose:** Create final file with hospitalizations that may have an HCBS composite or pressure ulcer event. This program formats the inpatient claims data and removes non-acute care claims, duplicate claims, claims outside of HCBS use or enrollment, and transfers.

**Input:** MedPAR and MAX IP claims, as well as the denominator file output from 01\_Prep\_Denominator.sas

**Output:** MedPAR and MAX data combined in one file.

**Support program:** CONTROL.sas

4) Modify and run the 03\_HCBS\_PQSAS1.sas program. This program is based on the PQI software. The user must modify the file pathways in lines 19 through 30. This program is a modification of the PQI version 4.4 software available on the AHRQ Quality Indicator website.

**Purpose:** Flag claims that include an HCBS composite or pressure ulcer event. Also, combines overlapping claims. Note that claims could not be combined in earlier steps otherwise diagnostic information would be lost.

**Input:** HCBS\_PQI\_INPUT, which was created in 02\_HCBS\_PQI\_Input.sas. This file includes cleaned and formatted Medicare- and Medicaid-paid discharges for HCBS users. HCBS\_PQI\_DENOM, the output file from 01\_Prep\_Denominator.sas, is needed as well.

**Output:** The most primary output is the HCBS\_PQI\_PERSON\_LEVEL file. This merges together numerator and denominator information. HCBS\_PQ1 is a discharge-level flag with flags for the HCBS composite and the pressure ulcer events. For diagnostic purposes, this file also outputs a file with discharges excluded from the program.

**Support programs:** The OVERLPAP.sas program combines overlapping stays. The FORMATS file lists the ICD-9 codes used for each concept (for example, pressure ulcer stage codes). CONTROL.sas defines macros.

- 5) Modify and run the 04\_RISK\_ADJUST.sas program. The user must modify the file pathways in lines 16 to 26.

**Purpose:** This produces state-level observed rates, risk-adjusted rates, and confidence intervals. First, it calculates a predicted number of PQI or Pressure Ulcer events. The coefficients used to estimate the predicted number are based on the 2010 HCBS user population described in the reports. Next, these results are aggregated to the state level. The programs calculate observed (unadjusted), expected, and risk-adjusted rates, as well as numerator and denominator counts.

**Input:** Person-level with HCBS composite and Pressure Ulcer flags (HCBS\_PQI\_PERSON\_LEVEL).

**Key data elements:** The acute, chronic, and pressure ulcer counts are contained in the ACUTE, CHRONIC, and PRESSURE\_ULCER variables, respectively. All other variables used in risk adjustment are already defined in the HCBS\_ANALYTIC\_FILE (Chapter 2).

**Output:** Separate files for each measure (ACUTE, CHRONIC, and PRESSURE\_ULCER) and MME group (MME or MED\_ONLY). Six output files are named: ACUTE\_MME, ACUTE\_MED\_ONLY, CHONRIC\_MME, CHONRIC\_MED\_ONLY, PRU\_MME, and PRU\_MED\_ONLY

These outputs are state-level files with observed (unadjusted), expected, and risk-adjusted rates and confidence intervals, as well as numerator and denominator counts. The output file has the following variables:

- STATE—Medicaid beneficiary's state
- NUM—Numerator. This is the count of composite or pressure ulcer events by state
- DENOM—Denominator. For the composites, this is the number of HCBS user-years by state. For Pressure Ulcer, this is the number of HCBS user-years by state, less hospice time for hospice use.
- USERS—the count of HCBS users in a given state, which is different from DENOM.
- OR—Observed (unadjusted) rate of events per 100,000 person-years by state.
- ER—Expected rate of events per 100,000 person-years by state.
- RAR—Risk-Adjusted Rate of events per 100,000 person-years by state.
- LOWER—lower bound of 95% confidence interval for risk-adjusted rate, by state. Assumes a normal distribution.
- UPPER—upper bound of 95% confidence interval for risk-adjusted rate, by state. Assumes a normal distribution.

**Supporting programs:** CONTROL.sas defines macros. The PARAMS\_## and ZERO\_PARAMEST\_## SAS data files hold the coefficients.