

# REPORT

FINAL REPORT

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## **Development of an HCBS Pressure Ulcer Measure, Volume 1**

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August 26, 2015

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**Submitted to:**

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## **ACKNOWLEDGMENTS**

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A number of people at Mathematica and other organizations made important contributions to this report. We would like to thank our government task lead, D.E.B. Potter, of the Office of Disability, Aging, and Long-Term Care Policy in the Office of the Assistant Secretary for Planning and Evaluation. We would also like to thank our CMS project officer, Effie George, and Mike Smith, Director of the Division of Community Systems Transformation, Disabled & Elderly Health Programs Group, Center for Medicaid & CHIP Services at the Centers for Medicare & Medicaid Services. In addition, we want to acknowledge the Mathematica programming staff, Haixia Xu, Dejene Ayele, and Dean Miller, as well as Eric Schone, Mariel Finucane and Nancy McCall for providing feedback on this report.

We also wish to thank the following participants in our HCBS Pressure Ulcer Measure Technical Expert Panel (TEP), who provided valuable guidance on the development of this measure: Robert Applebaum, PhD, of Scripps Gerontology Center; Elizabeth Ayello, PhD, RN, of Ayello, Harris, and Associates; Sigrid Bergenstein, NP, of Commonwealth Community Care; Kimberly Class of the Minnesota Department of Human Services; Sheila Eckenrode, RN, of Qualidigm; Ray Glazier, PhD, of Disability Research Associates, LLC; Ilene Henshaw of AARP; Jennifer Meddings, MD, of the University of Michigan School of Public Health; Chris Murtaugh, PhD, MPA, of the Visiting Nurse Service of New York; Cheryl Phillips, MD, of LeadingAge; and Clarke Ross, DPA, of the American Association of Health and Disability.

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## CONTENTS

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EXECUTIVE SUMMARY .....	IX
SECTION I PRELIMINARY MEASURE DEVELOPMENT .....	1
I. INTRODUCTION.....	3
II. BACKGROUND ON PRESSURE ULCER CODING IN CLAIMS DATA .....	5
III. DATA, POPULATIONS, AND METHODS .....	7
A. Denominator population .....	7
B. Exclusion criteria for inpatient claims .....	7
C. Alternative definitions of pressure ulcer events.....	8
D. Rate calculation .....	9
E. Descriptive statistics on pressure ulcer events .....	10
F. Calculation of HCBS pressure ulcer rates for additional populations by state.....	10
IV. RESULTS.....	13
A. Characteristics of 2009 HCBS user population .....	13
B. Impact of alternate numerator definitions .....	13
C. Pressure ulcer events by inpatient claim exclusion criteria .....	14
D. Analysis of present on admission information .....	16
E. Pressure ulcers among 2009 HCBS users, by state and MME status.....	18
F. Pressure ulcers among additional HCBS populations .....	20
V. DISCUSSION.....	23
A. Comparison of 2005 and 2009 pressure ulcer rates .....	23
B. Pressure ulcer rates for the 2010 HCBS user population, MFP participants, and those who transitioned without MFP from 2008 to 2010.....	24
C. Next steps for the pressure ulcer measure development.....	24
SECTION II HCBS PRESSURE ULCER MEASURE TEP SUMMARY.....	27
A. Importance of a state-level HCBS pressure ulcer measure .....	29
B. Specification of the proposed pressure ulcer measure .....	30
C. Next steps for measure development.....	33
SECTION III FINAL RECOMMENDED SPECIFICATIONS FOR THE HCBS PRESSURE ULCER MEASURE .....	35
Refinements to the Pressure Ulcer Measure .....	37

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A. Potential additional denominator exclusions .....	37
B. Potential numerator modifications .....	38
C. Results: Impact of new denominator and numerator changes .....	39
D. Final recommended measure specification and next steps .....	42
REFERENCES.....	47
APPENDIX A IDENTIFICATION OF MEDICAID BENEFICIARIES USING HCBS .....	A.1

## TABLES

---

I.1	Characteristics of the 2009 HCBS user population .....	13
I.2	Pressure ulcer events by numerator definition, 2009 .....	14
I.3	Pressure ulcer events removed due to inpatient claim exclusion criteria .....	15
I.4	Frequencies of pressure ulcer events among 2009 HCBS beneficiaries .....	16
I.5	POA analysis: presence of POA indicators among 2009 MME HCBS beneficiaries with stage III, IV, or unstageable pressure ulcer events .....	17
I.6	POA analysis: presence of POA indicators among 2009 beneficiaries with stage III, IV, or unstageable pressure ulcer events and Medicaid-paid discharges .....	18
I.7	Preliminary pressure ulcer events and observed rates (per 100,000 person-years) among 2009 HCBS users, by state .....	19
I.8	Preliminary pressure ulcer events and observed rates (per 100,000 person-years), by state and Medicare enrollment.....	21
III.1	Results from Section I: Pressure ulcer counts and observed rates before applying modifications .....	40
III.2	Interim results: Pressure ulcer numerator events and observed rates applying hospice exclusion with count-based numerator .....	40
III.3	Pressure ulcer numerator events and observed rates applying the binary numerator and hospice exclusion .....	42
III.4	Pressure ulcer events and observed rates (per 100,000 person-years) among 2009 HCBS users, by state.....	43
III.5.	Pressure ulcer events and observed rates (per 100,000 person-years) among the 2010 HCBS user population, by state .....	45

## FIGURES

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A.1	Defining the measure denominator.....	A.5
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## EXECUTIVE SUMMARY

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This is the first of two reports describing the iterative development of a measure to assess potentially avoidable hospitalizations due to pressure ulcers among Medicaid fee-for-service (FFS) beneficiaries using home- and community-based services (HCBS). This measure is intended to assess the quality of care for HCBS recipients under a shared accountability framework: the measure profiles the experience of the HCBS population and reflects care delivered by all providers (not just HCBS providers).

The Agency for Healthcare Research and Quality (AHRQ), U.S. Department of Health and Human Services, began the development of the HCBS pressure ulcer measure 10 years ago as directed by the Deficit Reduction Act of 2005. Through this process, AHRQ finalized a set of HCBS quality measures that included a measure of potentially avoidable hospitalizations due to pressure ulcers, which was adapted from Patient Safety Indicator 03 (PSI 03) (Schultz et al. 2012). Mathematica is tasked with updating this pressure ulcer measure definition to account for updated data sources, changes to diagnosis coding standards for pressure ulcer reporting, and current clinical practices for pressure ulcer prevention and treatment in the HCBS population.<sup>1</sup>

This report (Volume 1) documents the iterative process to refining AHRQ's pressure ulcer measure specification and summarizes: (1) Mathematica's preliminary investigation of several options for defining the pressure ulcer measure, (2) the presentation of these preliminary analyses to a Technical Expert Panel (TEP), and (3) final recommended measure specifications. Specifically, in Section I we explore the impact of different numerator and denominator definitions, use of present-on-admission (POA) information, and application of potential exclusion criteria. Medicaid beneficiaries utilizing HCBS in 2009 served as the primary population for this analysis; for comparison purposes results were also produced for Medicaid beneficiaries using HCBS in 2010, and Medicaid beneficiaries who recently transitioned from institutional long-term care settings to HCBS. On December 19th, 2014, these preliminary results were presented to the HCBS Pressure Ulcer TEP, which included clinicians with extensive experience treating pressure ulcers, HCBS providers, consumer advocates, measurement experts, and researchers familiar with the unique features of the Medicaid HCBS population. The TEP members provided guidance on the best available method for specifying the measure numerator, whether to consider POA information, and appropriate exclusions, as described in Section II. Section III details Mathematica's work to implement the TEP's recommendations and describes the final recommended specifications for the pressure ulcer measure, prior to risk-adjustment. The final recommended HCBS pressure ulcer measure can be summarized as follows:

- 1) Numerator specification: The measure numerator includes inpatient hospital admissions where a severe (Stage III, IV or unstageable) pressure is noted in any diagnosis code field

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<sup>1</sup> Mathematica is also tasked with building risk-adjustment models for two HCBS composite measures, which were also recommended by AHRQ for the HCBS population. The final risk-adjustment models for the HCBS composite measures and associated recommendations for addressing small sample sizes and appropriate benchmarks will be published in two volumes, and are available at <http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Long-Term-Services-and-Supports/Balancing-Money-Follows-the-Person.html>.

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on inpatient hospital claims. Each HCBS user will contribute up to one pressure ulcer event to the numerator, as opposed to the originally proposed numerator that allowed HCBS users to contribute more than one event to the numerator.

- 2) Numerator exclusions: On claims where POA information is available (i.e., those paid by Medicare), the pressure ulcer measure will exclude pressure ulcers that are acquired during the hospital stay. Any hospitalization where the date of admission is outside of a month of HCBS use or enrollment will be excluded from the numerator. The numerator excludes pressure ulcers that occur during months when a Medicaid beneficiary is using hospice care.
- 3) Denominator criteria: The pressure ulcer denominator counts each month of HCBS use or enrollment in a given calendar year (or within the observation period of interest). Like the numerator, the denominator excludes months of HCBS use or enrollment when a Medicaid beneficiary is using hospice care.

The report concludes by reporting national and state-level HCBS pressure ulcer rates for HCBS users in 2009 and 2010, and for policy-relevant subgroups of Medicaid beneficiaries who transitioned from institutional long-term care settings to HCBS.<sup>2</sup>

In addition to these refinements, the TEP also recommended the measure be risk-adjusted to control for the underlying differences in the health of HCBS users in different states, programs, or other entities of interest. This report does not address risk-adjustment for the HCBS pressure ulcer measure. A subsequent report (Volume 2) will detail the risk-adjustment model process for this measure, which represents the final phase of this work. This subsequent report (Volume 2) will also be accompanied by detailed measure specifications and SAS programming code for producing the observed (unadjusted) and risk-adjusted pressure ulcer measures for Medicaid FFS beneficiaries using HCBS.

The overarching goal of this work is to continue to develop quality measures that can be used to assess the care provided to Medicaid beneficiaries receiving long-term services and supports in the community. This report, as well as other reports related to the effort to develop quality measures for the HCBS population, can be found at: <http://www.medicaid.gov/Medicaid-CHIP-Program-Information/By-Topics/Long-Term-Services-and-Supports/Balancing-Money-Follows-the-Person.html>.

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<sup>2</sup> The state-level results in this report are descriptive and should not be used to rank performance. Instead, these results should be used to guide states or other stakeholders to further examine quality issues. The HCBS pressure ulcer measure needs further development if it is to be used for state profiling, including risk adjustment, reliability adjustment, establishing benchmarks, defining a statistical framework for comparison, and accounting for managed care HCBS users.

## **SECTION I**

### **PRELIMINARY MEASURE DEVELOPMENT**

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## I. INTRODUCTION

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The Centers for Medicare & Medicaid Services (CMS), the Agency for Healthcare Research and Quality (AHRQ), and the Office of Disability, Aging, and Long-Term Care Policy (DALTCP) in the Office of the Assistant Secretary for Planning and Evaluation (ASPE) are working to formalize a set of quality measures for Medicaid beneficiaries who use community-based long-term services and supports (LTSS). Until recently, the only quality measures available to evaluate outcomes or processes of care delivered to LTSS recipients were specific to institutional settings, such as hospitals or nursing homes. To fulfill this unmet need for those who use home- and community-based services (HCBS), Section 6086(b) of the Deficit Reduction Act of 2005 directed AHRQ to develop “program performance indicators, client function indicators, and measures of client satisfaction” for Medicaid beneficiaries receiving HCBS (109th United States Congress 2006). In response, AHRQ and its contractors developed a preliminary set of HCBS quality indicators (QIs) and in 2012 published a methodology report. The initial set of HCBS QIs included adaptations of existing AHRQ prevention quality indicators (PQIs) and patient safety indicators (PSIs) as well as newly developed measures (Schultz et al. 2012).

Through the Money Follows the Person (MFP) evaluation, CMS and its contractors enhanced these HCBS QIs by developing preliminary risk-adjustment models and a framework for state-by-state comparisons (Ross and Bohl 2013). The MFP Demonstration is a CMS initiative that allows Medicaid beneficiaries receiving LTSS in institutional settings to transition into the community and receive care through HCBS. A central question for the program is how the quality of care delivered to MFP participants compares with that of other Medicaid HCBS beneficiaries, including those receiving care through HCBS waiver programs and those who transition to HCBS from institutions without the MFP program.

One of the HCBS QIs recommended by AHRQ and its contractors was a measure of potentially preventable hospitalizations due to the development of pressure ulcers. Although AHRQ developed definitions for this HCBS pressure ulcer measure, significant changes have occurred in both International Classification of Diseases, 9<sup>th</sup> revision (ICD-9) diagnosis codes and the availability of present-on-admission (POA) data since that time. The original definitions were developed using 2005 Medicare and Medicaid-paid discharges, but starting in 2008, the ICD-9 diagnosis coding standards for pressure ulcers changed. The new standards require documentation of the severity of the ulcer, which is coded as stage I, II, III, IV, or unstageable. Furthermore, starting on October 1, 2008, acute inpatient prospective payment system (IPPS) hospitals are required to report the POA indicators for all Medicare discharges, to distinguish between events occurring before or during a hospital stay. These new data elements present an opportunity to refine and improve the HCBS pressure ulcer measure to identify the most severe pressure ulcers that occur in community-based settings (that is, outside of the hospital and nursing home settings). This identification was the stated intent of the HCBS pressure ulcer measure (Schultz et al. 2012).

This section of the report (Section I) re-examines the HCBS pressure ulcer measure using updated data. To inform future discussions with a technical expert panel, we explore alternative definitions for pressure ulcer events using site and stage codes and POA information. We also provide descriptive statistics on exclusion criteria for the inpatient claims for a population of Medicaid beneficiaries using HCBS in 2009. Using the best-available approach for defining severe pressure ulcer events with stage codes and POA information, we also calculate pressure

ulcer hospitalization rates for four populations: (1) 2009 HCBS users, (2) 2010 HCBS users, (3) MFP participants who transitioned from 2008 to 2010, and (4) Medicaid beneficiaries who transitioned to HCBS outside of MFP from 2008 to 2010. These four populations were identified during an earlier phase of this work that focused on developing risk-adjustment methods for three PQI composite measures. The 2009 and 2010 HCBS user populations represent the two most recent years for which Medicaid Analytic eXtract (MAX) data was available for a majority of states. Similarly, the 2008–2010 MFP and non-MFP transitioner populations represent the most complete years of data available to analyze the quality of HCBS delivered to Medicaid beneficiaries who recently transitioned from institutional into community LTSS.

At the end of Section I, we synthesize all findings to guide the future direction of the pressure ulcer work, including additional revisions to the pressure ulcer definition, concerns about pressure ulcer coding standards in the inpatient setting, and development of potential strategies for risk and reliability adjustment.

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## II. BACKGROUND ON PRESSURE ULCER CODING IN CLAIMS DATA

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The implementation of diagnosis codes indicating pressure ulcer severity and the advent of POA reporting provide improved mechanisms for characterizing pressure ulcers with claims data. Nonetheless it is important to recognize that coding guidelines and data availability continue to limit the ability to attribute a pressure ulcer to a particular health care setting. Prior to October 1, 2008, only pressure ulcer site codes (ICD-9 diagnosis codes 707.00-707.09) were available for identifying pressure ulcers. This coding system did not allow providers to indicate the severity (stage) of the pressure ulcer, or whether the ulcer developed before or after hospitalization (present on admission status). Starting on October 1, 2008, the ICD-9 coding standards were updated to require that all pressure ulcer site codes be accompanied by a stage code (ICD-9 codes 707.20-707.25). This update made it possible to distinguish between severe (stage III, IV, and unstageable) and nonsevere (stage I and II) pressure ulcers. In addition to the pressure ulcer coding change, beginning on October 1, 2008, hospitals must submit POA information for all primary and secondary diagnoses for all inpatient Medicare discharges to CMS. The POA indicator codes include the following classifications:

- diagnosis was present at time of inpatient admission (Y)
- diagnosis was not present at time of inpatient admission (N)
- documentation insufficient to determine whether condition was present at the time of inpatient admission (U)
- clinically undetermined; provider was unable to clinically determine whether the condition was present at the time of inpatient admission (W)<sup>3</sup>

As part of the hospital-acquired conditions (HAC) Deficit Reduction Act program, POA indicators are used on billing records in conjunction with pressure ulcer stage codes coded in secondary diagnosis code fields to adjust payments for Medicare fee-for-service payments.<sup>4</sup>

Despite the availability of stage and POA codes, it is difficult to identify the number of severe pressure ulcers that patients experience. According to guidelines, claims indicating that the patient had a pressure ulcer must indicate a site and stage code. Pressure ulcer site codes can occur in the primary diagnosis position, or any of the secondary diagnosis fields captured by the CMS data systems. In theory, pressure ulcer stage codes should be recorded in one of the secondary diagnosis fields. However, there is no requirement that the stage code occur in a particular secondary diagnosis field. Furthermore, because patients may incur pressure ulcers at multiple sites, coding guidelines allow hospitals to code more than one pressure ulcer site but to use only one pressure ulcer stage code on a claim, and the guidelines do not specify which stage

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<sup>3</sup> Centers for Medicare & Medicaid Services, Department of Health and Human Services. "Medicare Learning Network: Hospital-Acquired Conditions and Present on Admission Indicator Reporting Provision." September 2014. Available at <http://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/wPOAFactSheet.pdf>.

<sup>4</sup> For more information on the Deficit Reduction Act's use of the hospital-acquired conditions, see [https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/Hospital-Acquired\\_Conditions.html](https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/HospitalAcqCond/Hospital-Acquired_Conditions.html)

code to record. As such, if an individual has both a nonsevere and a severe pressure ulcer, the hospital has discretion about which pressure ulcer stage code to record on the claim.

Additionally, interpretation of the POA codes is complicated when a patient is admitted with a pressure ulcer. The coding guidelines require that patients who are admitted to the hospital with a pressure ulcer that progresses to a higher stage during the stay be recorded at the highest stage. As a result, a patient may be admitted with a nonsevere pressure ulcer (stage I or II) that progresses during the hospital stay to a severe pressure ulcer (stage III, IV, or unstageable) but is recorded as a severe pressure ulcer that was POA.

The availability of diagnosis codes also influences the number of pressure ulcer stage codes detectable on claims. Prior to January 2011, CMS captured only eight secondary diagnoses from claims. To accommodate more diagnosis codes to prepare for the ICD-10 conversion, CMS allowed hospitals to submit as many as 24 secondary diagnoses as of January 2011, but providers were not required to submit claims in this new format until July 1, 2012. Because stage codes are largely found in secondary diagnosis fields, and persons hospitalized with a pressure ulcer often have multiple comorbid conditions, the stage code may not be recorded in the eight secondary diagnosis fields in the CMS systems prior to July 2012 (Coomer and McCall 2012).

Further complicating measurement of pressure ulcers among the HCBS population, POA information is unavailable for Medicaid-paid discharges. To date, there are no standardized requirements across states for POA reporting to CMS for Medicaid discharges.<sup>5</sup> With Medicaid paying for the inpatient care of roughly one-quarter of HCBS users in 2009 and 2010, there is concern that the detection of pressure ulcers may vary depending on whether an individual is also enrolled in Medicare.

It is important to acknowledge the challenges of pressure ulcer coding and data availability because these issues are likely to result in an underestimation of severe pressure ulcers. However, because no other data currently exist to capture severe pressure ulcers among all HCBS users, a claims-based HCBS pressure ulcer measure may be the best option available to state Medicaid programs. Readers should consider these limitations when assessing the validity of the HCBS pressure ulcer measure and interpreting results.

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<sup>5</sup> Although the new Transformed MSIS (T-MSIS) system will provide a means for collecting POA information from Medicaid claims, the rollout of this system was still in progress as of April 2015. <http://www.medicaid.gov/Federal-Policy-Guidance/Downloads/SMD-13-004.pdf>.



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### III. DATA, POPULATIONS, AND METHODS

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For this analysis, we used Medicaid Analytic eXtract (MAX) person summary, other therapy, and inpatient files, as well as the Medicare Master Beneficiary Summary File (MBSF) and Medicare Payment Analysis and Review (MedPAR) file.<sup>6</sup>

#### A. Denominator population

The HCBS pressure ulcer analysis examines a population of Medicaid Fee-for-Service (FFS) beneficiaries who used HCBS during calendar year 2009. This population was defined under a prior contract with CMS and is described in detail in Appendix A (Ross and Bohl 2013). This population includes both Medicare–Medicaid enrollees (MMEs) and Medicaid-only beneficiaries with a claim for HCBS or record of HCBS waiver enrollment during the 2009 calendar year. We identified the HCBS population from 48 states and Washington, DC, with available MAX data.<sup>7</sup> Our analyses include individuals with at least one month of HCBS enrollment or use in calendar year 2009.<sup>8</sup> We exclude individuals with a record of Medicare or Medicaid managed care, and we include only individuals above the age of 18.

We used MAX person summary files to identify HCBS waiver status and Medicaid managed care enrollment, as well as demographic information. The MAX Other Services/Therapies file supplied information on HCBS use. The MBSF provided Medicare managed care enrollment and demographic information.

#### B. Exclusion criteria for inpatient claims

This section details the preliminary exclusion criteria considered for measure development; the final specifications are described in Section III. The Medicaid claims available in MAX inpatient files (“MAX inpatient”) and Medicare inpatient claims in the MedPAR file (“MedPAR file”) include claims for inpatient hospitalizations, and both of these files were used to identify severe pressure ulcer numerator events for our denominator population. However, prior to identifying severe pressure ulcer events, we followed a number of steps to process the inpatient claims.

First we combined Medicaid and Medicare inpatient discharge records for 2009 HCBS users. After combining these records, we removed MedPAR claims for skilled nursing care. Next, we used monthly indicators for Medicare and Medicaid enrollment to identify MMEs and Medicaid-only beneficiaries. For HCBS users who were MMEs, we searched through only 2009 MedPAR claims to identify pressure ulcer events in the months that they were dually eligible for Medicare and Medicaid; we also looked at MAX inpatient claims for MMEs in months when an individual was only eligible for Medicaid. For Medicaid-only beneficiaries, we searched 2009

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<sup>6</sup> For additional information on these data files see the Centers for Medicare & Medicaid Services (CMS) Research Data Assistance Center (ResDAC) at <http://www.resdac.org/>.

<sup>7</sup> Arizona and Hawaii were excluded from these analyses due to high managed care enrollment among the HCBS population.

<sup>8</sup> We include individuals with no HCBS waiver enrollment but multiple claims for HCBS services, such as personal care and case management, because these HCBS persons are not enrolled in HCBS waivers.

MAX inpatient claims, using the monthly indicators for Medicaid-only status to determine which months to search the MAX inpatient claims. To avoid double-counting events, and to more accurately attribute pressure ulcers during the time of HCBS waiver enrollment/HCBS use, we also applied the following exclusion criteria:

- **Non-acute-care discharge records.** We excluded MedPAR discharge records from non-acute-care facilities (skilled nursing facilities, inpatient psychiatric hospitals, etc.).
- **Overlapping claims.** All claims for a beneficiary that contained overlapping dates were aggregated into episodes that indicated the earliest admission date and latest discharge date. A maximum of one severe pressure ulcer event could be flagged during an episode, even if a beneficiary had multiple severe pressure ulcers flagged on claims falling within the episode.
- **Transfer to another facility.** As recommended by the AHRQ team that developed the original HCBS pressure ulcer measure, we excluded transfers to another inpatient facility that occurred immediately after discharge from the hospital with the index pressure ulcer stay. Because admission source is unavailable in Medicaid data, we retained index stays but removed all same-day readmissions to avoid double-counting.
- **Duplicate claims.** All claims for the same beneficiary with matching primary diagnosis, admission date, and discharge date were flagged as a duplicate and removed.
- **Admission outside of HCBS enrollment.** We excluded inpatient records when the admission month on the claim was not during a month of HCBS waiver enrollment or HCBS use.
- **Exclusions made by the PQI or PSI software.** Most HCBS QIs are adapted from AHRQ PQI or PSI measures. The PQI and PSI software commonly exclude any records with problematic age, gender, or discharge date information. We also excluded records with a length of stay less than zero or longer than 365 days, as well as admissions from an institutional setting (for example, nursing homes).

We examine the impact of these exclusions on the number of pressure ulcers that result in an inpatient hospital admission identified among HCBS users.<sup>9</sup>

### **C. Alternative definitions of pressure ulcer events**

After applying the exclusion criteria to the inpatient claims described above, we examined four definitions for pressure ulcer numerator events:

**Definition Number 1 (original definition used by AHRQ in 2012 HCBS Methods Report using site codes, ignoring stage codes and POA information).** The original HCBS pressure ulcer definition used only pressure ulcer site codes. This definition was developed with data from 2005 that preceded the introduction of pressure ulcer stage codes and POA information for Medicare discharges in October 2008.

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<sup>9</sup> Those interested in replicating these exclusion or getting further detail on these exclusion should refer to the measure calculation package that will accompany Volume 2 (Ross et al. 2015).

**Definition Number 2 (uses stage codes, ignores site codes and POA information).** The second numerator definition focuses only on pressure ulcer stage codes. We searched inpatient records and flagged discharges with a pressure ulcer stage code of III, IV, or unstageable (ICD-9 diagnosis codes 707.23, 707.24, and 707.25, respectively) in the primary or secondary diagnosis fields. Only eight secondary diagnosis fields are available in Medicaid and Medicare claims in the MAX and MedPAR data, respectively, during calendar year 2009.<sup>10</sup>

This definition takes a broad approach and ignores POA indicators and pressure ulcer site codes. Because POA indicators are available only for MedPAR data, the decision to include or ignore POA data is critical to create a pressure ulcer measure that reflects severe pressure ulcers developed in the community.

**Definition Number 3 (uses stage and site codes).** This definition flags discharges only if they have both a stage III, IV, or unstageable code and a pressure ulcer site code. The AHRQ Patient Safety Indicator (PSI) 03<sup>11</sup>, version 4.5, uses both stage and site codes, but this indicator applies other exclusions (for example, excluding discharges with a length of stay of less than five days) that we did not apply, because the purpose is to identify severe pressure ulcers that are acquired in a hospital.

**Definition Number 4 (uses stage codes and POA information, ignores site codes).** The fourth definition is a variation of the first definition. Pressure ulcer stage codes are used in combination with POA indicators. POA indicators are available on Medicare MedPAR records (for Medicare and Medicaid enrollees) but unavailable in Medicaid MAX (for Medicaid-only enrollees). Therefore, severe pressure ulcers for Medicare and Medicaid enrollees are counted as events only if they are coded as POA on the MedPAR record. All MAX inpatient records for Medicaid-only enrollees are treated as if the pressure ulcer were POA.

#### **D. Rate calculation**

The observed (unadjusted) rate for the time period of interest is calculated as the number of qualifying inpatient admissions with a severe pressure ulcer divided by the sum of months of HCBS user/enrollment among the denominator population. Final rates are represented with units of “pressure ulcer events per 100,000 person-years.”

$$\text{Rate of pressure ulcer events per 100,000 person-years} = \frac{\text{Number of qualifying severe pressure ulcer inpatient admissions}}{\text{Total number of HCBS person-months}} * 100,000 * 12$$

<sup>10</sup> Prior to January 2011, CMS captured only eight secondary diagnoses from claims. The CMS data systems capture as many as 25 diagnoses starting in January 2011.

<sup>11</sup> AHRQ Patient Safety Indicators (PSI) 03 identifies pressure ulcer rates at the hospital level. The full set of AHRQ PSIs provide information on adverse events that occur in a hospital setting. The specifications for PSI 03 are focused on severe pressure ulcers developed during an inpatient hospital stay. The technical specifications used for PSI 03 are available from AHRQ. [http://www.qualityindicators.ahrq.gov/Downloads/Modules/PSI/V45a/TechSpecs/PSI\\_03\\_Pressure\\_Ulcer\\_Rate\\_V45a.pdf](http://www.qualityindicators.ahrq.gov/Downloads/Modules/PSI/V45a/TechSpecs/PSI_03_Pressure_Ulcer_Rate_V45a.pdf).

## **E. Descriptive statistics on pressure ulcer events**

To understand the new data elements for identifying severe pressure ulcer numerator events among HCBS users, we produced the following descriptive statistics for the 2009 HCBS user population:

1. Descriptive characteristics of 2009 HCBS users in the denominator population.
2. Number of pressure ulcer events identified among 2009 HCBS users, for each of the four pressure ulcer numerator definitions.
3. Number of pressure ulcer events removed for each inpatient claim exclusion criteria, using numerator definition 4.
4. Frequency of pressure ulcer events among 2009 HCBS users using numerator definition 4.
5. Pressure ulcer POA and stage coding by diagnosis code position (primary vs. secondary) on MedPAR claims for 2009 MME HCBS users. POA indicators are not available on MAX inpatient records, so it is unclear how POA coding impacts Medicaid-only beneficiaries. Therefore, we also present results on POA indicators for Medicaid-paid discharges from Healthcare Cost and Utilization Project (HCUP) state inpatient databases (SID). This alternative data source allows us to examine how POA indicators might impact the number of numerator events for Medicaid-only beneficiaries.
6. Number of pressure ulcer events and rates among 2009 HCBS users, by MME status and by state, using numerator definition 4. For the rates, the numerator for each state is the sum of discharges with a severe pressure ulcer, where each inpatient record contributes up to one pressure ulcer event. The denominator is a sum of all months of waiver enrollment and HCBS use for 2009 HCBS users in that state, regardless of whether they were hospitalized. Final rates are represented with units of “pressure ulcer events per 100,000 person-years.”

## **F. Calculation of HCBS pressure ulcer rates for additional populations by state**

We also present pressure ulcer events and rates, by MME status and by state, for three additional HCBS populations for comparison. After applying all exclusion criteria and using numerator definition number 4, we calculated pressure ulcer rates for (1) Medicaid beneficiaries who used HCBS in 2010, (2) MFP participants who transitioned during the 2008 to 2010 period, and (3) Medicaid beneficiaries who transitioned to HCBS outside of the MFP program from 2008 to 2010. We used the 2010 population to validate rates produced among the 2009 population and to determine whether the same patterns of severe pressure ulcer rates emerged across years. The MFP and non-MFP transitioner populations are subgroups of interest among the HCBS user population, so we also wanted to compare rates for these subgroups. We describe these populations in more detail in Appendix A.

For the rates, the numerator for each state is the sum of discharges with a pressure ulcer, where each inpatient record contributes a maximum of one pressure ulcer event. For the 2010 HCBS user population, the denominator is the sum of all months of waiver enrollment and HCBS use for 2010 HCBS users in each of the 47 states and Washington, DC, for which MAX data is available, excluding Arizona and Hawaii due to high managed care enrollment among the

HCBS population. The denominator for the MFP participants who transitioned during the 2008 to 2010 period is the sum of months of HCBS enrollment or use among this transition population. For the beneficiaries who transitioned to HCBS outside of the MFP program, the denominator is the sum of months of HCBS enrollment or use among this transition population.

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## IV. RESULTS

### A. Characteristics of 2009 HCBS user population

This report (Volume 1) explores refinements to the measure specifications and presents unadjusted pressure ulcer rates, while Volume 2 focuses on the development of risk-adjustment models and reports risk-adjusted pressure ulcer rates (Ross et al. 2015). The population of Medicaid FFS HCBS users ages 18 and older in 2009 served as the sample for this pressure ulcer development work. After applying the denominator selection criteria described in Appendix A of this report, we identified 1,817,731 HCBS users who were eligible for inclusion in the measure denominator. Because we are producing unadjusted severe pressure ulcer rates for this population, it is important to understand the characteristics of beneficiaries who are included in the population. Most of these users were female (60.3 percent), and most (60.5 percent) were between the ages of 18 and 65 (Table I.1). The majority (83.9 percent) of the sample were enrolled in HCBS for at least 6 months during 2009. Two-thirds of the sample were enrolled for all 12 months of 2009, and all had at least one month of enrollment by definition of our denominator.

**Table I.1. Characteristics of the 2009 HCBS user population**

Characteristic	Percentage of 2009 HCBS users (n = 1,817,731)
Female	60.3
Age (years)	
18 to 24	8.7
25 to 44	20.9
45 to 64	30.9
65 to 74	13.6
75 to 84	15.2
85 or older	10.7
Medicare–Medicaid Eligible (MME)	73.9

Sources: Mathematica analysis of 2009 HCBS users. Data sources included the 2009 MAX PS and OT files; and 2009 MBSF file.

### B. Impact of alternate numerator definitions

After applying all inpatient claim exclusion criteria, we examined the number of events identified using each of the four numerator definitions. The choice of pressure ulcer definition had an important effect on the number of pressure ulcer events identified. Numerator definition number 1, which included records with pressure site codes but did not consider stage codes or POA information, was the most inclusive approach and aligns with the original definition developed by AHRQ (Table I.2). This definition identified 30,672 pressure ulcer events. In comparison, numerator definition 2, which used only stage codes, identified 42 percent fewer pressure ulcers (n = 17,695), while definition number 4, which used stage codes and POA information from MedPAR claims, similarly identified 43 percent fewer pressure ulcers (n =

17,387) (Table I.2). Using definition 3, which required both a stage and site code, had the greatest impact on pressure ulcer counts, reducing the number of events by 60 percent compared with AHRQ's original approach (definition 1).

Because numerator definition 4 represents the best available data on pressure ulcer stage and POA indicators for MME beneficiaries available for our population, this definition is used in subsequent analyses of potential exclusion criteria. However, an HCBS Pressure Ulcer TEP provided guidance on which numerator definition is ultimately recommended (the summary of the TEP discussion is included in Section II, and the final definition is presented in Section III).

**Table I.2. Pressure ulcer events by numerator definition, 2009**

Pressure ulcer event definition	Medicaid-only HCBS beneficiaries	MME HCBS beneficiaries	Total
Number 1	6,078	24,594	30,672
Number 2	3,485	14,210	17,695
Number 3	2,420	9,869	12,289
Number 4	3,485	13,902	17,387

Source: Analytic file of 2009 Medicaid beneficiaries (MMEs and Medicaid only) who were enrolled in or used HCBS during the month of the pressure ulcer event, were at least 18 years of age, and were enrolled in fee-for-service Medicare and/or Medicaid (Appendix A). Pressure ulcer events were identified through MAX and MedPAR records.

Note: The events listed in this table are totals after applying all exclusion criteria described in Section I, Part III.B. This does not include the hospice exclusion discussed in Section III of this report.

### C. Pressure ulcer events by inpatient claim exclusion criteria

We next evaluated the impact of each exclusion criterion on the count of pressure ulcers identified among 2009 HCBS users, using numerator definition number 4. In total, 11,794 discharges with a stage III, IV or unstageable pressure ulcer code were removed using the proposed exclusion criteria (presented in Table I.3). Because the exclusion criteria are not mutually exclusive, some excluded records met more than one of the criteria. The most common reason for excluding a pressure ulcer discharge was that it occurred during a month when a Medicaid beneficiary was not enrolled in a waiver or using HCBS. This criterion alone excluded 6,056 events. It is a new HCBS QI exclusion criterion recommended by Mathematica, which was not applied to the original measure definition developed by AHRQ. Removing the MAX inpatient claims for MME beneficiaries also had a notable impact, resulting in the exclusion of 3,063 pressure ulcer events. Stays in non-acute-care hospitals excluded 658 pressure ulcer events, and transfers excluded 417 events.<sup>12</sup>

<sup>12</sup> Those interested in replicating these exclusion or getting further detail on these exclusion should refer to the measure calculation package that will accompany Volume 2 (Ross et al. 2015).



**Table I.3. Pressure ulcer events removed due to inpatient claim exclusion criteria**

MAX claims for MME beneficiary	Reason for exclusion					Number of events
	Non-acute hospital stay	Duplicate	Not in HCBS	Transfer	Overlapping stay	
			✓			6,056
✓						3,063
✓			✓			852
	✓					658
				✓		417
	✓		✓			372
			✓	✓		257
		✓				38
		✓	✓			72
					✓	8
		✓		✓		1
Total:						11,794

Source: Analytic file of 2009 Medicaid beneficiaries (MMEs and Medicaid only) who were enrolled in or used HCBS during the month of the pressure ulcer event, were at least 18 years of age, and were enrolled in fee-for-service Medicare and/or Medicaid (Appendix A). Pressure ulcer events were identified through MAX and MedPAR records.

After removing the 11,794 events based on the exclusion criteria, 17,383 discharges remained that met the inclusion criteria for a pressure ulcer event. Less than one percent (11,520 of 1,817,731) of all 2009 HCBS users had one or more hospital admissions with a pressure ulcer (Table I.4). Of those HCBS users with a pressure ulcer discharge, 88.70 percent (10,218) had one or two inpatient discharges indicating stage III or IV pressure ulcers. For a small number of HCBS users, we identified more than four hospitalizations with severe pressure ulcers, but it is unclear whether this finding is due to repeated hospitalizations for the same pressure ulcer, multiple hospitalizations for different pressure ulcers, or to data quality issues. Further investigation is needed for individuals with large numbers of pressure ulcer events.

**Table I.4. Frequencies of pressure ulcer events among 2009 HCBS beneficiaries**

Number of pressure ulcer events	Percentage of all 2009 HCBS beneficiaries	Number of all 2009 HCBS beneficiaries	Total pressure ulcer events
0	99.37	1,806,211	0
1	0.45	8,171	8,171
2	0.11	2,047	4,094
3	0.04	702	2,106
4	0.02	318	1,272
5	0.01	131	655
6	< 0.01	72	432
7	< 0.01	34	238
8	< 0.01	19	152
9	< 0.01	14	126
10	< 0.01	6	60
11	< 0.01	2	22
12	< 0.01	2	24
13	< 0.01	1	13
22	< 0.01	1	22
Total	100	1,817,731	17,387

Source: Analytic file of 2009 Medicaid beneficiaries (MMEs and Medicaid only) who were enrolled in or used HCBS during the month of the pressure ulcer event, were at least 18 years of age, and were enrolled in fee-for-service Medicare and/or Medicaid (Appendix A). Pressure ulcer events were identified through MAX and MedPAR records.

Note: For these analyses, we defined an event as any discharge with a stage III, IV, or unstageable pressure ulcer indicated on a discharge record, regardless of diagnosis code position; additionally, events identified on MedPAR records had a POA indicator.

#### **D. Analysis of present on admission information**

The intent of the pressure ulcer measure is to capture pressure ulcers attributable to the care provided to Medicaid beneficiaries enrolled in HCBS. Although POA indicators are unavailable in 2009 MAX inpatient records, all 2009 MedPAR records have POA information. To better understand the impact of using POA information in the measure definition, we analyzed the distribution of POA indicators on MedPAR records among 2009 MME HCBS users with stage III, IV, or unstageable pressure ulcer events (Table I.5). For this analysis, we examined events among MME beneficiaries after applying the exclusion criteria described in Part III.B, and utilizing numerator definition 4. We stratified the results based on diagnosis code position, because the primary diagnosis, which should represent the main reason for hospital admission, is almost always reported as POA and because pressure ulcer stage codes should be coded as secondary diagnoses.

As expected given ICD-9 pressure ulcer coding guidelines, we found that nearly all pressure ulcer codes in the primary diagnosis position are site codes rather than stage codes. Therefore,

including information beyond the primary diagnosis has a large impact on pressure ulcer rates when using stage codes. The vast majority (98.00 percent) of pressure ulcer stage III, IV, or unstageable diagnosis codes were coded as POA in MedPAR records (Table I.5). Note that some discharge records have multiple pressure ulcer stage codes, which explains why the number of pressure ulcer codes in Table I.5 does not exactly match the pressure ulcer counts in Table I.2.

**Table I.5. POA analysis: presence of POA indicators among 2009 MME HCBS beneficiaries with stage III, IV, or unstageable pressure ulcer events**

Stage diagnosis	POA indicator presence	Primary diagnosis	Secondary diagnoses
Stage III	Yes	6	6,997
	No	0	173
Stage IV	Yes	9	7,200
	No	1	138
Unstageable	Yes	0	643
	No	0	14

Source: 2009 MedPAR discharges for MMEs who were enrolled in or used HCBS during the month of the pressure ulcer event. Secondary diagnoses include diagnosis code positions two through nine.

Note: Under "POA indicator presence," "yes" includes indicator values of Y, W, 1, or 0, and "no" includes values of N or U. One pressure ulcer stage code diagnosis had a POA indicator value of W. Stage III, IV, and unstageable diagnoses correspond to ICD-9-CM codes 707.23, 707.24, and 707.25, respectively.

Because nearly all pressure ulcers are POA on MedPAR claims, including all pressure ulcers from MAX claims is unlikely to yield many events that would have been excluded if POA data were available (i.e., false positives). However, to better understand the POA indicators among Medicaid-paid discharges, we also analyzed POA coding for pressure ulcer stage codes in the HCUP SID. We examined all Medicaid-paid discharges from 12 states (AR, AZ, CA, FL, IA, KY, MA, MD, NE, NJ, NY, and WA). These states were selected because their HCUP SID datasets include comparatively complete POA indicator reporting. The analysis of POA indicators on HCUP SID records produced results similar to our analyses of 2009 MME beneficiaries using MedPAR data (Table I.6). Nearly all pressure ulcer diagnoses are recorded in a secondary position (20,822 out of 20,846), and most (97.38 percent) pressure ulcer diagnoses are POA.

**Table I.6. POA analysis: presence of POA indicators among 2009 beneficiaries with stage III, IV, or unstageable pressure ulcer events and Medicaid-paid discharges**

Stage diagnosis	POA indicator presence	Primary diagnosis	Secondary diagnoses
Stage III	Yes	5	7,854
	No	0	289
Stage IV	Yes	19	11,238
	No	0	203
Unstageable	Yes	0	1,184
	No	0	54

Source: Records from the 2009 HCUP SID from 12 states (AR, AZ, CA, FL, IA, KY, MA, MD, NE, NJ, NY, WA) indicating a stage III, IV, or unstageable pressure ulcer diagnosis. Secondary diagnoses include diagnosis code positions two through nine.

### E. Pressure ulcers among 2009 HCBS users, by state and MME status

Among the 2009 HCBS user population, the 17,387 pressure ulcer events were distributed across 49 states for an overall rate of 1,152 events per 100,000 HCBS enrollment years (Table I.7). Of the 48 states with available data, 32 had more than 100 pressure ulcers in 2009. States with the highest number of pressure ulcer events tend to be the states with large HCBS user populations: California (2,363 events), Illinois (1,648 events), New York (1,643 events), North Carolina (936 events), Texas (940 events), and Virginia (874 events). The states with the greatest number of events, however, are not necessarily the states with the highest rates. Virginia had the highest pressure ulcer rate (3,490 events per 100,000 person-years), but Texas and New York have rates near the overall average. California's rate (671 events per 100,000 person-years) is lower than the overall rate (1,152 events per 100,000 person-years). New Mexico has the lowest rate: 200 events per 100,000 person-years.

The rate of pressure ulcers varied by whether the Medicaid beneficiary was also enrolled in Medicare (Table I.7). The overall pressure ulcer rate among MME enrollees is more than 25 percent higher than the overall rate for Medicaid-only HCBS users, but this relationship is not constant by state. Pressure ulcer rates among MMEs may be greater, because HCBS users who are enrolled in Medicare tend to be older and have greater levels of disability than Medicaid-only HCBS users. More research is needed to understand whether demographic or health condition risk factors explain the variation in pressure ulcer rates across states, motivating the risk-adjustment work in Volume 2 (Ross et al 2015).

The results stratified by MME status also provide an indication of the HCBS users in each state. New Mexico has zero events for Medicaid-only HCBS users. Further examination shows that New Mexico has the smallest Medicaid-only HCBS user population, likely because of the high use of Medicaid managed care in the state. Based on these results, other stratum-level comparisons may be unstable for states with small populations.

**Table I.7. Preliminary pressure ulcer events and observed rates (per 100,000 person-years) among 2009 HCBS users, by state**

State	Count	Overall rate	MME rate	Medicaid-only rate
Overall	17,387	1,152	1,227	927
AK	31	630	833	139
AL	172	1,319	1,865	306
AR	230	1,497	1,797	525
CA	2,363	671	761	434
CO	153	693	654	796
CT	192	890	877	944
DC	127	2,528	2,433	2,674
DE	35	1,336	1,445	981
FL	641	1,283	1,656	139
GA	393	1,925	1,760	2,259
IA	109	475	468	506
ID	39	415	519	176
IL	1,648	1,839	1,636	2,341
IN	251	1,474	1,685	937
KS	235	1,111	1,320	564
KY	170	1,180	1,595	369
LA	505	2,342	2,675	1,860
MA	268	791	820	682
MD	101	644	466	2,064
MI	750	1,786	1,730	2,530
MN	194	604	550	696
MO	501	1,039	1,040	1,035
MS	311	2,389	2,348	2,558
MT	36	723	781	605
NC	936	1,298	1,288	1,325
ND	8	283	236	426
NE	65	755	827	528
NH	61	961	994	872
NJ	455	1,290	1,282	1,374
NM	4	200	218	0
NV	107	1,648	1,772	1,366
NY	1,643	1,145	1,292	638
OH	742	1,290	1,643	47
OK	344	1,384	1,284	1,724
OR	76	695	708	650

State	Count	Overall rate	MME rate	Medicaid-only rate
PA	557	2,095	2,407	575
RI	32	707	984	0
SC	510	2,744	2,859	2,380
SD	19	475	356	884
TN	10	1,495	1,468	1,501
TX	840	981	1,029	795
UT	12	322	484	69
VA	824	3,490	3,571	3,288
VT	40	734	794	563
WA	332	696	720	632
WI	99	903	771	1,309
WV	199	1,792	1,828	1,722
WY	17	543	521	604

Source: Analytic file of 2009 Medicaid beneficiaries (MMEs and Medicaid only) who were enrolled in or used HCBS during the month of the pressure ulcer event, were at least 18 years of age, and were enrolled in fee-for-service Medicare and/or Medicaid (Appendix A). Pressure ulcer events were identified through MAX and MedPAR records.

## F. Pressure ulcers among additional HCBS populations

We also examined severe pressure ulcer events and rates by state and MME status for (1) Medicaid beneficiaries who used HCBS in 2010, (2) MFP participants who transitioned during the 2008 to 2010 period, and (3) Medicaid beneficiaries who transitioned to HCBS outside of the MFP program from 2008 to 2010. Pressure ulcers were identified using numerator definition 4 and all proposed exclusion criteria.

Among 2010 HCBS users, we identified 18,147 events distributed across 47 states (Table I.8). The overall rate in the 2010 population is 3 percent higher than the 2009 overall rate. This increase may be partly because there were 27 states with higher rates in 2010 than in 2009, including states with comparatively high numbers of HCBS users (for example, CA, NY, and VA). In general, states with pressure ulcer rates below average in 2009 also had below average rates in 2010. Similar to the 2009 results, the pressure ulcer rate among MMEs is higher than the rate among Medicaid-only HCBS users (state-level data not shown).

Using the 2008 to 2010 MFP participant population, we identified 217 events across 29 states (Table I.8). State-level rates among MFP participants vary greatly but should be interpreted with extreme caution (state-level data not shown). Although states like Texas, Michigan, and California have a meaningful number of MFP participants, most state's rates are very unstable because they are based on a small number of events and relatively small HCBS user population. For example, Delaware has only three events but its rate is more than three times the overall MFP average. This estimate is subject to substantial sampling variance due to the small sample size in Delaware, implying that the observed high rate may be due to chance alone. For example, given Delaware's sample size, even if Delaware's true underlying rate were in fact equal to the overall MFP average, there would still be an 8 percent chance of observing

three or more events just by chance. In larger states, by contrast, sampling variance is not as problematic. Michigan, for example, has more than 15 times as much data as Delaware. With this amount of data, the observed rate is more precise: if Michigan's true underlying rate were in fact equal to the overall MFP average, there would be less than a 1 percent chance of observing 41 or more events just by chance. In this sense Michigan has a sufficiently large sample size to provide a stable estimate of the rate.

We identified 751 pressure ulcer events among non-MFP participants, but similar to MFP participants, the state-level pressure ulcer results for the non-MFP population are unstable, because some states had few events and relatively small numbers of people transitioning to HCBS (Table I.8). The overall rate in the non-MFP population (2,082 pressure ulcers per 100,000 person-years) is roughly 17 percent lower than the overall rate for the MFP population (2,696 pressure ulcers per 100,000 person-years); however, any inferences between these two populations should first account for health status and demographic differences, which are notable (Ross et al. 2012). Final state-level pressure ulcer observed rates for these populations are found in Section III of this report. Volume 2 includes risk-adjusted pressure-ulcer rates for these populations (Ross et al. 2015).

**Table I.8. Preliminary pressure ulcer events and observed rates (per 100,000 person-years), by state and Medicare enrollment**

Population	Count	Overall rate	MME rate	Medicaid-only rate
2010 HCBS users	18,147	1,188	1,281	909
MFP Participants 2008 - 2010	217	3,224	3,709	2,403
Non-MFP Transitioners 2008 - 2010	751	2,747	2,546	3,649

Source: Analytic files of (1) 2010 Medicaid beneficiaries who were enrolled in or used HCBS during the month of the pressure ulcer event, (2) MFP participants who transitioned to HCBS between 2008 and 2010 and (3) Medicaid beneficiaries who transitioned to HCBS outside of the MFP program between 2008 and 2010. All beneficiaries were at least 18 years of age, and were enrolled in fee-for-service Medicare and/or Medicaid (Appendix A). Pressure ulcer events were identified through MAX and MedPAR records.

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## V. DISCUSSION

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Section I details our preliminary process to develop a revised HCBS pressure ulcer measure. Of the four numerator options considered, we recommend a numerator definition that identifies hospital admissions with severe pressure ulcers using stage codes and POA indicators from MedPAR claims (number 4), because it includes the most complete data available for the HCBS population at this time. Compared with the original definition developed for AHRQ, which considered only site codes (number 1), the recommended definition identified fewer pressure ulcer events, because it focused on severe pressure ulcers using stage codes. However, the stated intent of the HCBS pressure ulcer measure is to focus on severe pressure ulcers, and thus utilizing stage code information seemed appropriate (Schultz et al. 2012). Similarly, we decided against using a definition that required both a stage and site code (number 3), because it may undercount severe pressure ulcers, as only nine diagnosis codes are available for analysis during the data time period. Results using only pressure ulcer stage codes without POA information (number 2) differed by only 1.5 percent compared with the best-available definition. Thus, using POA information does not have a large effect on the total number events identified. Because of ICD-9 coding guidelines and data availability, all definitions are likely to undercount the number of severe pressure ulcers that actually occur (final recommendations for the pressure ulcer measure are listed in Section III).

Using the best-available definition of the pressure ulcer measure (number 4), we identified more than 17,000 hospitalizations with stage III, IV, or unstageable pressure ulcers in the 2009 HCBS user population, for an overall rate of 1,152 pressure ulcer events per 100,000 person-years of HCBS enrollment. Notably, the pressure ulcer rate for HCBS users who are MMEs is roughly 25 percent greater than the rate for those enrolled in Medicaid only. This finding suggests that the age and disability status of HCBS users may be associated with pressure ulcer risk. We also observed variation in the state-level HCBS pressure ulcer rates; the rate varied roughly tenfold between the lowest and highest states. From these results alone, it is unclear whether this variation reflects differences in quality of care or the case mix of HCBS populations in each state.

### A. Comparison of 2005 and 2009 pressure ulcer rates

To place our results in context, we compared our 2009 results with those AHRQ produced for 2005 HCBS users with the original pressure ulcer measure definition. AHRQ reports a rate of 3,500 pressure ulcers per 100,000 HCBS users, which is three times greater than the rate we calculated among 2009 HCBS users using a revised definition.

Our analysis suggests that the reasons for this discrepancy include changes in the pressure ulcer definition, and the exclusion criteria, both of which reduced measured rates. First, our analysis using data from 2009 HCBS users shows that the rate doubles when AHRQ's original definition (our definition number 1) is applied instead of the new definition. Second, we applied a refined set of exclusion criteria. Our analysis shows removing duplicate records and requiring the pressure ulcer event to occur during HCBS enrollment resulted in lowered rates. Several other factors may have affected rates, though the direction of their effects is unclear. The 2009 MAX and MedPAR files reflect updated ICD-9 coding to identify pressure ulcers, and the

quality of the MAX and MedPAR data are changing over time. Also, because access to HCBS has expanded over time, it is possible that the profile of people using HCBS changed substantially between 2005 and 2009. In addition, the set of states included in the 2009 analysis is slightly different from the states included in the 2005 analysis. Lastly, the AHRQ rates were calculated as annualized quarterly rates, while we calculated rates based on annualized person-months.

## **B. Pressure ulcer rates for the 2010 HCBS user population, MFP participants, and those who transitioned without MFP from 2008 to 2010**

In addition to our detailed analyses of the 2009 population, we also applied the recommended pressure ulcer definition to the 2010 HCBS user population. In general, we find that the 2010 pressure ulcer rates are slightly higher than the 2009 rates. Reasons for this increase are unclear, but it could represent increasing risk for the HCBS user population over time. It is also possible that select groups of Medicaid beneficiaries join or leave the HCBS population over time, changing the profile of HCBS users from one year to the next. This possibility may result from changes in program or waiver eligibility, or if states shift certain Medicaid beneficiaries into managed care plans. These changes could result in different risk profiles of beneficiaries in different years.

We also applied numerator definition 4 and the exclusion criteria described previously to MFP participants and non-MFP transitioners, finding that the overall pressure ulcer rates for these two transitioner populations were higher than for HCBS users in general. Regardless of the definition used to identify pressure ulcers, state-level rates for the MFP and non-MFP groups should be interpreted with caution. Because of small sample sizes and the relatively small number of events, state-level rates for these populations will need statistical adjustment (such as applying minimum case size restrictions or a shrinkage estimator to reduce the variance of the estimates) before they are used for any evaluation or policy initiative.

## **C. Next steps for the pressure ulcer measure development**

Based on these results, the recommended HCBS pressure ulcer definition improves on the previous definition, which used only pressure ulcer site codes and was developed before POA information was available on MedPAR records. However, further work is required to use this measure to understand the quality of HCBS care delivered to Medicaid HCBS beneficiaries, either over time or between states. Specifically, our findings suggest the need to consider several conceptual questions, as well as detailed questions on the technical specifications of the measure.

### **Conceptual questions**

1. Importance: Is there evidence that measuring severe pressure ulcers acquired outside of the inpatient setting is important for the Medicaid HCBS user population (i.e., shows disparities across populations)?
2. Usability: Can the intended users understand the results of the measure and employ them for quality improvement and decision-making?
3. Feasibility: Can the measure be implemented with readily available data that avoids undue burden?

4. Scientific soundness: Does the measure produce consistent and credible results about the quality of care?

### Technical questions

1. Is the recommended numerator definition (#4) appropriate? Or should the pressure ulcer numerator use other diagnostic information to identify numerator cases, such as stage I or II pressure ulcer codes or pressure ulcer location codes?
2. Is the recommended approach of utilizing POA information available in MedPAR data appropriate, or is it problematic, because MAX records do not include POA information?
3. Does the recommended approach of excluding certain types of hospitals or facilities, such as psychiatric facilities or rehabilitation hospitals, meet the intent of the measure?
4. Should the measure capture pressure ulcer hospitalizations (events) or pressure ulcer episodes? The measure currently captures hospitalizations, and it is possible that the same pressure ulcer is coded on two separate discharges. If intent is to capture episodes, how should you define a unique episode?
5. To better attribute pressure ulcer events to the quality of HCBS, should the numerator consider the amount of time that a person is enrolled in HCBS? Similarly, should the denominator include only those enrolled in HCBS for a minimum amount of time?
6. Should the denominator include all HCBS users or consider only those HCBS users who are at an elevated risk for pressure ulcers? For example, the PSI 03 measure removes high-risk individuals from the numerator by removing discharges with diagnoses indicating severe mobility limitations or an immunocompromised state.
7. What types of information are most useful to states who want to compare their rates against relevant benchmarks? Given that the data sources (MedPAR versus MAX) have different information available, should overall state rates be presented or should rates only be presented separately for MME and Medicaid only beneficiaries?

The intent of the results detailed in this section is to provide preliminary analyses that consider some of these issues, make initial recommendations for defining a HCBS pressure ulcer measure, and outline additional conceptual and technical considerations that still must be addressed. Although this report does contain state-level information and rates, readers should interpret these data with caution, especially for states with small HCBS user populations or with a small number of events. Finally, to make appropriate comparisons, it is necessary to account for variations in case mix and available information across states, between populations, and over time. We do not examine these issues in this report, but they are important areas for future development.

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## **SECTION II**

### **HCBS PRESSURE ULCER MEASURE TEP SUMMARY**

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On December 19, 2014, Mathematica convened a TEP on behalf of the CMS and ASPE to solicit input on the development of the pressure ulcer measure for Medicaid beneficiaries HCBS. During this TEP, Mathematica presented the results for the proposed HCBS pressure ulcer measure that are included in Section I of this report, and TEP members were asked to provide input on the following topics:

- the importance of a state-level measure assessing severe pressure ulcers in the HCBS population
- how the proposed measure should be specified, including exclusion criteria and numerator definitions
- technical issues related to calculating and reporting state-level results, such as the need for risk-adjustment, stratification, or reliability-adjustment; and
- additional analyses needed to guide the development of this measure.

The TEP participants included Robert Applebaum, PhD, of Scripps Gerontology Center; Elizabeth Ayello, PhD, RN, of Ayello, Harris, and Associates; Sigrid Bergenstein, NP, of Commonwealth Community Care; Kimberly Class of the Minnesota Department of Human Services; Sheila Eckenrode, RN, of Qualidigm; Ray Glazier, PhD, of Disability Research Associates, LLC; Ilene Henshaw of AARP; Jennifer Meddings, MD, of the University of Michigan School of Public Health; Chris Murtaugh, PhD, MPA, of the Visiting Nurse Service of New York; Cheryl Phillips, MD, of LeadingAge; and Clarke Ross, DPA, of the American Association of Health and Disability.<sup>1</sup>

This section summarizes the TEP's feedback and recommendations, and concludes with immediate next steps for this measure development effort.

### **A. Importance of a state-level HCBS pressure ulcer measure**

The first topic of discussion was the importance of a state-level measure of severe pressure ulcers among HCBS users. Overall, TEP members agreed that there is a need for such a measure; however, to be meaningful, the measure must take into consideration interstate variations in HCBS populations and resources. Experts cautioned against using the pressure ulcer measure only to compare the quality of HCBS care between states, particularly because differences in state waivers result in dramatic variation from state to state in HCBS populations and resources. One suggestion for making the measure more applicable to interstate comparisons was to provide context for state-level variation alongside the measure—for instance, by presenting the measure in tandem with an assessment of a state's available HCBS resources. The panel also recommended that the measure account for different subpopulations of HCBS users. For instance, ambulatory HCBS users are at lower risk for developing pressure ulcers, whereas non-ambulatory users are at very high risk; a pressure ulcer measure would benefit each of these populations, but in different ways. Thus Mathematica was advised to stratify the measure by risk level, or risk-adjust the measure to account for comorbidities among HCBS recipients.

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<sup>1</sup> During a separate call on December 16, Jennifer Meddings provided feedback that we also include in this summary.

The TEP's main concern with state-level reporting was that the claims data on which the measure is based is not fully representative of pressure ulcers among HCBS users. Several clinicians explained that some HCBS recipients with severe pressure ulcers will receive outpatient care in settings such as wound clinics, instead of receiving hospital care. In these instances, inpatient hospital claims do not capture severe pressure ulcers; therefore, the measure should consider information from non-hospital settings. Moreover, because the current measure is limited to fee-for-service claims data, it does not reflect pressure ulcers in HCBS users in states with large managed care enrollment. Many experts advocated for incorporating managed care data into the measure to fully capture pressure ulcers in the HCBS population, and suggested that this approach would also increase the measure's applicability to care received outside the hospital. They also cited the growing prevalence of managed care, and thus the need to create a measure that accounts for this population of HCBS users.

## **B. Specification of the proposed pressure ulcer measure**

### **1. Exclusion criteria**

The TEP next considered the numerator exclusions used in the preliminary measure development work, which included hospital admissions outside of HCBS use or enrollment, hospital transfers, duplicate claims, overlapping claims, and problematic age, gender, or date variables. In particular, Mathematica inquired whether these exclusions are appropriate, and whether additional exclusions are necessary. Most experts agreed that hospice patients should be excluded from the numerator, and one expert also recommended excluding palliative care. Participants noted that the ideology of hospice differs markedly from that of curative treatment: hospice prioritizes comfort over health; therefore, pressure ulcer prevention is not a primary goal. In addition, a top priority is often to keep end-of-life patients at home as long as possible. A patient in a home care setting may not be receiving professional care and may thus be at increased risk of severe pressure ulcers. This factor coincides with the accelerated breakdown and increased fragility of skin present in end-of-life patients, which both further intensify the risk of severe pressure ulcers. For these reasons, most experts felt that inclusion of hospice patients would diminish the measure's usefulness in representing HCBS care quality.

A possible concern with this approach is that excluding hospice patients could lead to gaming by care professionals who incentivize premature enrollment in hospice; the expert raising this concern, however, still supported the proposed exclusion. Another argument in favor of including hospice patients was that a severe pressure ulcer present upon entering hospice would be indicative of (HCBS) care received up to that point. Unfortunately, because such information would not be available in claims data, experts reiterated that additional data would be necessary to fully evaluate the quality of HCBS care. Several participants recommended using, in addition to claims data, the Home Health Outcome and Assessment Information Set (OASIS), which includes several items assessing the presence of pressure ulcers, including whether any were present at discharge. These data might enable tracking of pressure ulcers present on admission to hospice.

Another suggested exclusion criteria was a minimum number of months of HCBS enrollment or use. The TEP noted that often a severe pressure ulcer can prompt HCBS enrollment, at which point an HCBS provider may determine that the pressure ulcer requires immediate hospital attention. Requiring a minimum number of HCBS months would prevent



wrongly attributing severe pressure ulcers in such cases to the quality of HCBS care. Similarly, an exclusion for a minimum number of HCBS months in a specific state would help ensure that the measure attributes pressure ulcers to the state in which they developed. For instance, if an HCBS user moves from one state to another, and a severe pressure ulcer is discovered shortly after moving, that pressure ulcer should be attributed to the first state of residence, not the second. For this reason, experts felt an exclusion based on a minimum number of months would also increase the reliability of state-level reporting.

Finally, the panel discussed the fact that patient choice can influence the occurrence of these events. Participants noted that typically patients want to receive care at home for as long as possible, and/or can be resistant to care. In such cases, severe pressure ulcers can develop or worsen but do not reflect quality of HCBS care.

With the exceptions of excluding hospice patients and requiring a minimum number of HCBS months, the panel did not suggest that the measure numerator needed any additional exclusions. Mathematica inquired about employing the AHRQ Patient Safety Indicator (PSI) 03 exclusions, but experts advised that this approach would exclude individuals who would benefit most from an HCBS pressure ulcer measure and therefore should be included.<sup>2</sup>

## 2. Numerator definitions

The TEP was then asked to consider the proposed measure's numerator definition, which uses diagnosis codes indicating the pressure ulcer's stage (that is, severity) to limit the measure to severe stage III and IV pressure ulcers, and present on admission (POA) information for Medicare-Medicaid eligible beneficiaries to identify events occurring before hospital admission. Although one participant noted that the Medicare Patient Safety Monitoring System (MPSMS) does not restrict pressure ulcers by stage, the TEP generally agreed that stage I and II pressure ulcers should be excluded from the measure Mathematica is developing. Clinical experts emphasized that stage I and II pressure ulcers are significantly less serious than stage III and IV pressure ulcers, often not coded, and easily misdiagnosed. Unlike stage III and IV pressure ulcers, the status of stage I and II pressure ulcers can change hourly, and inter-rater reliability is low. One expert noted that stage I and II pressure ulcers are the most remediable, and others commented that pressure ulcers of these stages are very rarely cause for a hospital admission. In fact, experts explained that pressure ulcers of any stage are rarely cause for a hospital admission unless an underlying condition, such as osteomyelitis or another infection, is suspected. For this reason, the panel recommended incorporating data from wound care clinics, home nursing, and non-acute care hospital stays to capture the majority of pressure ulcers among HCBS users.

When discussing pressure ulcer stage codes, several experts voiced concerns over the definition of "unstageable." Mathematica was advised to compare the definition of "unstageable" used in measure development (ICD-9 diagnosis code 707.25) with that used by Long-Term Care Hospitals (LTCH) to ensure congruency. On a related note, one expert pointed out that pressure ulcers caused by medical devices on mucosal tissue are not included under the ICD-9 707.25

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<sup>2</sup> The AHRQ PSI 03 measure employs the following exclusions that could apply to the HCBS pressure ulcer measure: any ICD-9 diagnosis code for hemiplegia, paraplegia, quadriplegia; any ICD-9 diagnosis code for spina bifida, or anoxic brain damage; and Major Diagnosis Categories 9 (skin, subcutaneous tissue, and breast) or 14 (pregnancy, childbirth, and puerperium).

diagnosis code, and they should be excluded from the numerator if they are not already. TEP members once more urged Mathematica to use OASIS data to develop a full picture of HCBS pressure ulcers, at least among home health users.

With respect to the use of POA data, experts recommended that Mathematica stratify the measure for the Medicaid-only population, as there is no POA information for this group on hospital claims data.

Instead of the count-based approach, the TEP noted that, ideally, the severe pressure ulcer measure would capture pressure ulcer episodes. The TEP was unenthusiastic about the current count-based measure that considers readmissions for a single pressure ulcer as separate events because even with very high quality care, a pressure ulcer can take 6 to 12 months to fully heal. An episode-based approach would ideally identify unique pressure ulcers, not repeat hospitalizations for the same ulcer. Each HCBS user could contribute more than one episode to the numerator, but the numerator will be lower than the count-based approach.

To identify pressure ulcer episodes, the TEP suggested distinguishing a readmission from a new pressure ulcer episode by comparing the site codes across claims. As another possibility, the TEP suggested a two-year look back to determine whether a previous pressure ulcer is healed.

As a simpler alternative, the measure could use a numerator that reports the proportion of HCBS users with at least one pressure ulcer hospitalization (a binary yes/no specification). Compared to the original count-based approach, which may over-count distinct pressure ulcer events, the binary specification cannot capture the care experience of individuals experiencing multiple severe pressure ulcer hospital admissions. An episode-based approach is the ideal medium between these two options, though it may be difficult to do using only claims data.

### **3. Reporting considerations**

The TEP next focused on several issues related to reporting and interpreting the information captured by this measure. The first topic of discussion was how to handle HCBS users who present with a high number of pressure ulcer events; this issue is important, because an individual who has had one pressure ulcer is at a significantly elevated risk for developing more. Overall, experts agreed that individuals who have had previous pressure ulcers should be a high priority target for the measure specifically because they are at such a high risk for subsequent pressure ulcers. However, the panel maintained that risk-adjustment is crucial to making this measure meaningful, and one member recommended reporting two measures—one for HCBS users at high risk for developing a pressure ulcer, and one for those at low risk. Participants cautioned Mathematica about making generalizations to determine high versus low risk. In particular, one expert pointed out that it is usually assumed that individuals with developmental disabilities are ambulatory, however many have co-occurring disabilities that can affect their susceptibility to pressure ulcers. Hence any assessment of patient risk should consider all available diagnosis codes on claims files.

Finally, the TEP was asked to provide feedback on Mathematica's initial state-level results, and for any additional comments or concerns. The group restated the importance of looking further than claims data to capture the majority of pressure ulcers in the HCBS population. Experts encouraged the use of OASIS data as a source for capturing pressure ulcers present on

admission for home health recipients and as a means of obtaining mobility assessment data that could aid in risk-adjustment efforts. One expert also suggested incorporating as possible additional data sources pressure ulcer history and documentation from Meaningful Use standards. A recommendation for improving the measure in its current state was to report the proportion of the HCBS population in each state enrolled in managed care and thus not covered by the measure. This method could also improve the state-to-state comparability of the measure. A number of experts expressed that the measure should be reported as a rate, and several pointed out that the measure actually revealed interstate differences in access to services and implementation of HCBS programs, in addition to quality of care.

Both stratification and risk-adjustment were agreed to be important next steps, and experts urged that at a minimum, the measure needs to be stratified for dual status. The panel advised looking into additional risk factors such as COPD, smoking, diabetes, mobility, and skin conditions that can be miscoded as pressure ulcers. Additionally, one expert said it may be useful to analyze pressure ulcers in California, as the state is entirely self-directed. Another expert proposed examining MFP and non-MFP transitions from long-term care into an HCBS waiver program together instead of separately, as all transitioners are treated identically under state waivers.

### **C. Next steps for measure development**

Based on the TEP's feedback, Mathematica, CMS and ASPE will consider the following future steps for the measure's development in Section III of this report:

- Inclusion of additional settings for identifying severe pressure ulcers (non-acute care hospitals, wound care clinics, physician visits, and others) and other data sources such as OASIS
- Investigation of the episode-based, count-based, and binary approaches to specifying the numerator.
- Exclusions for hospice patients
- Requirement for a minimum amount of HCBS use
- Stratification by Medicare-Medicaid Eligible vs. Medicaid-only status
- Clarification of the unstageable pressure ulcers currently captured in the 707.25 diagnosis code
- Stratification and/or risk-adjustment to account for differences in patient risk and ensure appropriate comparisons
- Presentation of state-level results accompanied by contextual information on the proportion of managed care, available HCBS resources, and other relevant state-level information

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## **SECTION III**

# **FINAL RECOMMENDED SPECIFICATIONS FOR THE HCBS PRESSURE ULCER MEASURE**

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## **Refinements to the Pressure Ulcer Measure**

Based on recommendations from the HCBS Pressure Ulcer TEP, Mathematica investigated several refinements to the HCBS pressure ulcer measure. In Section III, we evaluate the proposed changes to the measure numerator and denominator, and we present new results of pressure ulcer events and rates, by MME status and by state, for the 2009 HCBS user population, the 2010 HCBS user population, Money Follows the Person (MFP) participants who transitioned during the 2008 to 2010 period, and Medicaid beneficiaries who transitioned to HCBS outside of the MFP program from 2008 to 2010. Next, we explore one change—an episode-based approach to counting pressure ulcer events—that was recommended by the TEP. Lastly, we describe the final recommended measure specifications, and next steps for the measure development.

### **A. Potential additional denominator exclusions**

The goal of the pressure ulcer measure is to identify among HCBS beneficiaries severe pressure ulcers that were potentially preventable, and may indicate a need for improvements in health care quality delivered to the HCBS population. The TEP favored additional exclusions for the denominator population to meet this goal, including removing from the denominator beneficiaries receiving hospice care and exploring the effect of a minimum number of months that a beneficiary must be enrolled in or using HCBS to be part of the denominator population.

#### **Excluding HCBS users in hospice care**

The TEP suggested the measure exclude beneficiaries receiving hospice services due to the differing goals of end-of-life care and curative treatment. Although hospice patients may be at risk for pressure ulcers, hospice settings prioritize comfort over treatment, and any pressure ulcers developed during hospice would not be indicative of poor quality care. Therefore, hospice patients are not representative of other HCBS populations and should not be included in a measure focusing on HCBS users.

To identify hospice patients for exclusion, we first created finder files for each of our HCBS populations. For Medicaid-only beneficiaries, we pulled hospice claims for beneficiaries in the finder files from the Medicaid Analytic eXtract (MAX) Other Services/Therapies file. For MMEs, we pulled hospice claims for beneficiaries in the finder files from the MAX Other Services/Therapies and Medicare Hospice files. We then flagged hospice use for each month based on these claims. Months during which a beneficiary was flagged as an HCBS user/enrollee and was also flagged as using hospice services were excluded from the denominator.

#### **Implementing a minimum and consecutive HCBS use criteria**

The TEP also recommended that we consider a minimum number of months of HCBS enrollment or use for a beneficiary to be included in the denominator population. The development of a pressure ulcer may prompt the use of HCBS, and the pressure ulcer is not necessarily indicative of the quality of HCBS care if it developed prior to the start of services.

To address this recommendation, we determined consecutive months of HCBS use or enrollment per beneficiary. To be included in the denominator, we required beneficiaries have at least one interval of three consecutive months of HCBS use or enrollment. Any beneficiary who did not have at least one interval of three or more consecutive months of HCBS use/enrollment

was excluded from the denominator. Additionally, because our denominator is a sum of person-months, we included only months of HCBS use/enrollment that were part of a qualifying interval of three or more consecutive months, and we excluded any months of HCBS use/enrollment that were not part of a qualifying interval.

Of note, this restriction is most relevant for attributing pressure ulcers to HCBS providers, which is not the intent of this measure. Instead, this measure aims to capture the quality of care received by HCBS users under a shared accountability framework, holding all providers accountable (as approximately 74% of HCBS users are MME/Dual eligible who receive care from Medicaid HCBS providers as well as Medicare health care providers). As such, we explore the impact of this potential modification, but based on HHS guidance it is not implemented in the final measure specification.

## **B. Potential numerator modifications**

After investigating potential denominator modifications, we also investigated changes to the numerator to align with the TEP's feedback. Of the original numerator definitions in Section I, the TEP preferred Definition 4. This definition identifies severe pressure ulcers by looking at stage codes (but not site codes) and incorporates POA information (which is only available on Medicare MedPAR claims in our analysis). Therefore, we investigate these potential modifications to Definition 4.

### **Excluding unstageable pressure ulcers**

After reviewing coding guidelines, we concluded it was appropriate to continue including unstageable pressure ulcers in the measure numerator. We investigated this change because one TEP member suggested examining the guidelines for pressure ulcers that are coded as “unstageable” to ensure that they exclude pressure ulcers caused by medical devices on mucosal tissue. According to ICD-9-CM Official Guidelines for Coding and Reporting (effective October 1, 2011), “code 707.25, pressure ulcer, unstageable...is used for pressure ulcers whose stage cannot be clinically determined (e.g., the ulcer is covered by eschar or has been treated with a skin or muscle graft).”<sup>1</sup> Further, in its position statement on mucosal pressure ulcers, the National Pressure Ulcer Advisory Panel (NPUAP) states, “The staging system for pressure ulcers of the skin cannot be used to stage mucosal pressure ulcers. The position of the NPUAP is that pressure ulcers on mucosal surfaces are not to be staged using the pressure ulcer staging system.”<sup>2</sup> In additional guidance, NPUAP notes that an unstageable pressure ulcer “will be either a Category/Stage III or IV.”<sup>3</sup> Therefore based upon the recommendations of the NPUAP, we continue to include unstageable pressure ulcers in the measure.

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<sup>1</sup> ICD-9-CM Official Guidelines for Coding and Reporting, effective October 1, 2011, are available at [http://www.cdc.gov/nchs/data/icd/icd9cm\\_guidelines\\_2011.pdf](http://www.cdc.gov/nchs/data/icd/icd9cm_guidelines_2011.pdf).

<sup>2</sup> The NPUAP position statement is available at [http://www.npuap.org/wp-content/uploads/2012/03/Mucosal\\_Pressure\\_Ulcer\\_Position\\_Statement\\_final.pdf](http://www.npuap.org/wp-content/uploads/2012/03/Mucosal_Pressure_Ulcer_Position_Statement_final.pdf).

<sup>3</sup> This guidance is available at <http://www.npuap.org/resources/educational-and-clinical-resources/npuap-pressure-ulcer-stagescategories/>.



### Specifying the numerator to be episode-based, count-based, or binary

The results in Section I use a count-based numerator, but as discussed in Section II, the TEP preferred an episode-based pressure ulcer numerator. Identifying unique pressure ulcer episodes may not be feasible using claims data, so as a potential alternative, we also explore a binary approach, which avoids counting multiple hospital admissions for the same ulcer. The three definitions we investigate are as follows:

1. **The count-based approach.** This is the approach developed by AHRQ and used in Section I of the report. Under the count-based approach, all hospitalizations meeting the pressure ulcer criteria are included in the numerator, and as such, one HCBS user can contribute multiple events to the numerator. This will count multiple hospitalizations for the same ulcer in the numerator.
2. **The episode-based approach.** This approach would identify unique pressure ulcers, not repeat hospitalizations for the same ulcer. Each HCBS user could contribute more than one episode to the numerator. The TEP suggested distinguishing a readmission from a new pressure ulcer episode by looking at site codes to determine whether pressure ulcers presented in different positions, and by using a two-year look back to determine whether a previous pressure ulcer was healed.
3. **The binary approach.** As an alternative to the count- and episode-based approaches, it is also possible to define the numerator as the proportion of HCBS users with at least one pressure ulcer event in a calendar year. This avoids the problem of counting multiple hospitalizations for the same pressure ulcer, but will not distinguish between separate pressure ulcer episodes.

### C. Results: Impact of new denominator and numerator changes

To investigate how the potential numerator and denominator modifications influence results, we implemented these changes, one-at-a-time, to illustrate the marginal impact of each one. First, we review results calculated using the count-based approach described in detail in Section I of this report. Next, we examine the marginal impact of each potential change to the measure, and conclude with final recommended measure specifications.

#### Original Pressure Ulcer Results (Count-based)

The original pressure ulcer rates developed in Section I are shown in Table III.1, and utilize a count-based approach. This is the starting point in our investigation. In general, there MME HCBS users have higher rates than Medicaid-only HCBS users; however these results are not risk adjusted.

**Table III.1. Results from Section I: Pressure ulcer counts and observed rates before applying modifications**

Population	Number of Events	Overall rate	MME rate	Medicaid-only rate
2009	17,387	1,152	1,227	927
2010	18,147	1,188	1,281	909
MFP Participants (2008 – 2010)	217	3,224	3,709	2,403
Non-MFP Transitioners (2008 – 2010)	751	2,747	2,546	3,649

Source: Analytic files of 2009 and 2010 Medicaid beneficiaries who were enrolled in or used HCBS during the month of the pressure ulcer event, were at least 18 years of age, and were enrolled in fee-for-service Medicare and/or Medicaid (Appendix A); MFP participants who transitioned to HCBS between 2008 and 2010; and Medicaid beneficiaries who transitioned to HCBS outside of the MFP program between 2008 and 2010. Pressure ulcer events were identified through MAX and MedPAR records.

Note: State-level results for these populations are presented in Tables III.4 - 7.

### Impact of the Hospice Exclusion

Compared with the original pressure ulcer results in Table III.1, the counts and rates of severe pressure ulcer events decreased markedly for all populations after applying the potential hospice criteria (Table III.2). The hospice exclusion decreased the number of events by approximately 16 percent in the 2009 HCBS population and 248,117 months from the original denominator. As a result, 2009 rates reduced by 5 percent. The impact of the hospice exclusion varied by state; for example, Ohio and Florida experienced decreases of 20 and 19 percent, respectively, in the count of qualifying pressure ulcers (data not shown). The hospice exclusion had a similar impact on the 2009 and 2010 populations. In general, the hospice exclusion had a greater impact on the MME population compared with the Medicaid-only counterparts.

**Table III.2. Interim results: Pressure ulcer numerator events and observed rates applying hospice exclusion with count-based numerator**

Population	Number of Events	Overall rate	MME rate	Medicaid-only rate
2009	16,271	1,093	1,155	908
2010	16,970	1,126	1,205	895
MFP Participants (2008 – 2010)	201	3,039	3,505	2,260
Non-MFP Transitioners (2008 – 2010)	661	2,987	2,801	3,601

Source: Analytic files of 2009 and 2010 Medicaid beneficiaries who were enrolled in or used HCBS during the month of the pressure ulcer event, were at least 18 years of age, and were enrolled in fee-for-service Medicare and/or Medicaid (Appendix A); MFP participants who transitioned to HCBS between 2008 and 2010; and Medicaid beneficiaries who transitioned to HCBS outside of the MFP program between 2008 and 2010. Pressure ulcer events were identified through MAX and MedPAR records.

### **Application of minimum and consecutive HCBS use criteria**

We did not implement the criteria of having at least three consecutive HCBS months, but we describe its impact on results. We did not implement this change because it is most suited for a measure trying to attribute pressure ulcers to HCBS care, which is not the intent of our measure, and is not possible to accurately specify because we analyze pressure ulcers with calendar year data only (not historic data). This change would have decreased pressure ulcer rates by 5 to 10 percent, depending on the population (data not shown).

### **Exploration of an episode-based approach**

During the TEP, panelists noted that even with high-quality care, some individuals develop severe pressure ulcers that may not fully heal for 6 to 12 months, and certain pressure ulcers become chronic. Therefore, some admissions with a severe pressure ulcer on the claim may be a pressure ulcer that is still healing. TEP members agreed that an episode-based approach for counting numerator events is superior to counting every admission with a severe pressure ulcer diagnosis on the claim. They suggested examining pressure ulcer site codes in addition to severity codes to distinguish a readmission from a new pressure ulcer episode.

Based on the TEP's recommendation to count a maximum of one inpatient admission per beneficiary per year for a severe pressure ulcer that occurs at the same site, we explored pressure ulcer site diagnosis codes on the inpatient claims for beneficiaries with a severe pressure ulcer event. We found that 2,921 out of 15,123 hospital claims for the 2009 HCBS population had more than one pressure ulcer site diagnosis code on a claim that met the severe pressure ulcer event criteria. However, because ICD-9 codes do not identify which site is associated with the severe pressure ulcer diagnosis code, it is difficult to distinguish unique episodes. Additionally, with only eight secondary diagnosis fields available on claims during the time period for our populations, there is uncertainty about attributing the correct site code to the severe pressure ulcer episode, because other site codes may be unobservable in the data.

As a result of these challenges, it is not possible to implement a valid episode-based approach at this time. With the conversion to ICD-10 codes, revised pressure ulcer diagnosis codes will be available that define both site and stage in the same diagnosis code. These new diagnosis codes, in addition to the availability of 24 secondary diagnosis fields, will make future development of an episode-based approach more feasible.

### **Impact of implementing a binary numerator specification**

Finally, we calculated the number of persons with at least one pressure ulcer and rates for our populations of interest, excluding those in hospice care, as shown in Table III.3. Because the numerator focuses on persons, rather than pressure ulcer events, we observe a decrease in events for HCBS users in 2009, 2010, MFP participants, and non-MFP transitioners relative to Table III.2. However, similarly to the count-based approach, MME HCBS users generally have higher rates than Medicaid-only HCBS users. State rates calculated using the two approaches (binary and count-based) are also highly correlated. In the 2010 HCBS user population, state rates have a rank sum correlation of 0.99. This indicates that the count-based approach does not provide substantively different information about the experience of HCBS users in different states.

**Table III.3. Pressure ulcer numerator events and observed rates applying the binary numerator and hospice exclusion**

Population	Number of persons with one or more pressure ulcers	Overall rate	MME rate	Medicaid-only rate
2009	11,520	636	700	453
2010	11,137	609	672	431
MFP Participants (2008 – 2010)	123	1,654	1,858	1,297
Non-MFP Transitioners (2008 – 2010)	407	1,378	1,344	1,492

Source: Analytic files of 2009 and 2010 Medicaid beneficiaries who were enrolled in or used HCBS during the month of the pressure ulcer event, were at least 18 years of age, and were enrolled in fee-for-service Medicare and/or Medicaid (Appendix A); MFP participants who transitioned to HCBS between 2008 and 2010; and Medicaid beneficiaries who transitioned to HCBS outside of the MFP program between 2008 and 2010. Pressure ulcer events were identified through MAX and MedPAR records.

#### D. Final recommended measure specification and next steps

Following the recommendations of the HCBS Pressure Ulcer TEP described in Section II, we refined the measure definition in an iterative fashion. Our final recommendation is to exclude HCBS users in hospice from the denominator and numerator, and to only count one pressure ulcer per HCBS user in the numerator (the binary approach). The results for each population of interest using the recommended specification are shown in Table III.3., with state-level observed results presented at the conclusion of this report (Tables III.4. – 5).<sup>4</sup>

In addition to the revisions considered in Section III, the TEP members also agreed that risk-adjustment is necessary for meaningful comparisons across states. In this regard, the binary approach simplifies the risk-adjustment process, because logistic regression can be used instead of count models (e.g., negative binomial or Poisson). In our next steps, we will augment our pressure ulcer measure database with candidate risk factors and begin model building. The model building process, validation steps, and final model specifications will be presented in Volume 2, along with risk-adjusted state-level results.

Although TEP members agreed that a state-level severe pressure ulcer measure is important for the HCBS population, several of the experts suggested that other information should be presented alongside the results to provide context, particularly for state-level benchmarking. Specifically, the TEP recommended reporting characteristics such as the proportion of HCBS users in each state that are enrolled in managed care, and thus not captured by the measure, and information about the waivers provided in each state. This type of information could improve state-to-state comparisons of the rates. To be responsive to this recommendation, we will work to

<sup>4</sup> These results should not be used to compare states or populations until they are adjusted for case mix differences, as detailed in Volume 2 (Ross et al. 2015).

compile information on state-level characteristics for the period of analysis, and we will present the information with the state-level pressure ulcer measure results.

Lastly, we acknowledge the importance of including additional care settings (other than inpatient hospitals) to identify severe pressure ulcer events. However, this TEP recommendation is outside the current scope of this work.

**Table III.4. Pressure ulcer events and observed rates (per 100,000 person-years) among 2009 HCBS users, by state**

State	Number of persons with one or more pressure ulcers	Number of HCBS users (MME and Medicaid-only)	Overall rate	MME rate	Medicaid-only rate
Overall	11,520	1,810,902	636	700	453
AK	22	5,974	368	476	113
AL	113	15,780	716	1,011	193
AR	173	19,152	903	1,062	408
CA	1,609	405,086	397	465	233
CO	107	26,200	408	421	376
CT	127	26,044	488	500	440
DC	69	6,565	1,051	1,079	1,010
DE	24	3,007	798	933	397
FL	453	64,132	706	950	88
GA	240	23,776	1,009	961	1,105
IA	83	27,235	305	297	339
ID	31	11,114	279	362	89
IL	944	106,126	890	872	929
IN	171	20,758	824	943	516
KS	153	25,262	606	702	363
KY	119	19,385	614	842	191
LA	317	26,712	1,187	1,477	801
MA	183	43,189	424	455	308
MD	71	17,867	397	311	1,054
MI	442	50,234	880	876	930
MN	138	37,837	365	351	389
MO	337	61,757	546	542	556
MS	220	15,582	1,412	1,378	1,539
MT	30	6,466	464	498	409
NC	565	90,975	621	652	540
ND	7	4,278	164	148	224
NE	43	10,236	420	434	374

Table III.4 (continued)

State	Number of persons with one or more pressure ulcers	Number of HCBS users (MME and Medicaid-only)	Overall rate	MME rate	Medicaid-only rate
NH	47	7,354	639	673	549
NJ	294	42,638	690	696	629
NM	3	2,170	138	154	0
NV	73	8,150	896	951	777
NY	1,157	163,672	707	816	344
OH	507	72,771	697	872	33
OK	236	29,645	796	750	944
OR	59	13,416	440	475	312
PA	351	32,198	1,090	1,280	252
RI	25	5,959	420	600	0
SC	325	21,603	1,504	1,551	1,358
SD	17	4,622	368	281	660
TN	5	760	658	1,316	493
TX	603	101,612	593	617	498
UT	11	4,579	240	339	61
VA	542	34,721	1,561	1,623	1,381
VT	31	6,674	464	474	439
WA	237	56,748	418	451	327
WI	60	13,925	431	405	500
WV	133	13,387	994	1,035	919
WY	13	3,569	364	386	307

Source: Analytic file of 2009 Medicaid beneficiaries (MMEs and Medicaid only) who were enrolled in or used HCBS during the month of the pressure ulcer event, were at least 18 years of age, and were enrolled in fee-for-service Medicare and/or Medicaid (Appendix A). Pressure ulcer events were identified through MAX and MedPAR records.

Note: Rates estimated from small numbers of HCBS users may be unreliable and should be interpreted with caution.

**Table III.5. Pressure ulcer events and observed rates (per 100,000 person-years) among the 2010 HCBS user population, by state**

State	Number of persons with one or more pressure ulcers	Number of HCBS users (MME and Medicaid-only)	Overall rate	MME rate	Medicaid-only rate
Overall	11,137	1,828,364	609	672	431
AK	24	6,575	365	437	201
AL	99	16,102	615	864	172
AR	148	19,625	754	854	442
CA	1,577	387,600	407	481	226
CO	114	27,510	414	426	386
CT	132	26,906	491	537	323
DC	72	8,264	871	803	968
DE	30	3,001	1,000	1,152	456
FL	459	66,834	687	892	37
GA	271	38,705	700	803	517
IA	75	27,526	272	246	385
ID	0	13,442	0	0	0
IL	865	105,520	820	776	937
IN	196	21,184	925	1,022	692
KY	105	19,777	531	711	201
LA	314	30,754	1,021	1,244	744
MA	172	45,073	382	411	296
MD	64	18,928	338	281	769
MI	457	51,508	887	888	883
MN	132	40,909	323	338	297
MO	287	63,319	453	458	439
MS	208	16,716	1,244	1,237	1,269
MT	24	6,943	346	382	290
NC	527	85,833	614	586	689
ND	13	4,491	289	253	431
NE	38	10,128	375	423	233
NH	48	7,536	637	640	629
NJ	354	44,727	791	778	910
NM	4	2,090	191	211	0
NV	72	8,594	838	897	707
NY	1,142	162,542	703	787	401
OH	415	79,575	522	655	0
OK	221	29,500	749	767	694

Table III.5 (continued)

State	Number of persons with one or more pressure ulcers	Number of HCBS users (MME and Medicaid-only)	Overall rate	MME rate	Medicaid-only rate
OR	63	13,076	482	522	314
PA	418	37,585	1,112	1,288	251
RI	26	5,823	447	572	0
SC	346	22,328	1,550	1,681	1,185
SD	16	4,710	340	307	444
TN	1	234	427	3,571	0
TX	643	111,732	575	621	400
UT	12	4,427	271	287	244
VA	507	35,918	1,412	1,379	1,513
VT	30	6,396	469	533	293
WA	208	58,648	355	339	397
WI	58	11,473	506	553	390
WV	134	14,610	917	970	816
WY	16	3,667	436	453	393

Source: Analytic file of 2010 Medicaid beneficiaries (MMEs and Medicaid only) who were enrolled in or used HCBS during the month of the pressure ulcer event, were at least 18 years of age, and were enrolled in fee-for-service Medicare and/or Medicaid (Appendix A). Pressure ulcer events were identified through MAX and MedPAR records.

Note: Rates estimated from small numbers of HCBS users may be unreliable and should be interpreted with caution.



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**APPENDIX A**

**IDENTIFICATION OF MEDICAID BENEFICIARIES USING HCBS**

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## A. Data sources and analytic file construction

The analytic files developed for this work relied on both Medicare and Medicaid administrative data files, because most home- and community-based services (HCBS) users are Medicare–Medicaid enrollees (MMEs). The analytic files required can be categorized into three primary segments: (1) the denominator population, (2) inpatient stays for individuals in the denominator, and (3) person-level chronic comorbidity information from the patient’s history used to establish patient risk.<sup>1</sup> Unless otherwise indicated, the methods described in the following subsections apply to all four analytic populations used for this work.

### 1. Denominator population

To establish the population of eligible Medicaid HCBS users, we used version 4.2 of the denominator specifications developed by Agency for Healthcare Research and Quality (AHRQ), which are summarized in Figure A.1. To first establish the baseline group of Medicaid beneficiaries (including Medicaid-only beneficiaries and MMEs) using HCBS services, we drew on 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 Services/Therapies (OT) files.<sup>2</sup>

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, intellectually/developmentally disabled, mental illness, technologically dependent, unspecified, 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.

To identify the populations of Money Follows the Person (MFP) participants and Medicaid beneficiaries who transitioned to HCBS outside of MFP, we imposed some additional steps that were not relevant to the 2009 or 2010 HCBS user populations. For the MFP participants, we drew from Mathematica’s MFP administrative files to identify participants between 2008 and 2010. Only MFP participants that had matching records in MAX PS files were retained. All MFP participants, by definition, were enrolled in or using HCBS after they transitioned from

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<sup>1</sup> Risk-adjustment was not used for the pressure ulcer measure; therefore the third data source is not applicable to this report.

<sup>2</sup> For additional information on these data files see the Centers for Medicare & Medicaid Services (CMS) Research Data Assistance Center (ResDAC) at <http://www.resdac.org/>.

<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.

institutional long-term care. Therefore, we defined months of HCBS enrollment or use starting in the month of the transition to HCBS until the end of follow-up. The end of follow-up was 12 months after the transition date if the MFP participant was not reinstitutionalized, did not die, and had a full 12 months of post-transition data available (no data censoring). If the MFP participant was reinstitutionalized, died, or had data censoring, then the end of follow-up was set to the date of the first occurring outcome. Using this methodology, a beneficiary could contribute up to 12 person-months to the denominator for the pressure ulcer rates.

For the Medicaid beneficiaries who transitioned to HCBS outside of MFP between 2008 and 2010, we applied the methodology for identifying HCBS users described previously but applied additional restrictions. For HCBS users between January 1, 2008 and March 31, 2010, a transition from institutional long-term care was identified if there were at least 181 days of care observed in an MFP-eligible institution (that is, a nursing facility, institutional care facility for people with intellectual disabilities, or institution for mental diseases) and HCBS use occurred within three months of discharge. For HCBS users between April 2010 and December 2010, a transition from institutional long-term care was identified if there were at least 91 days of care observed in an MFP-eligible institution and HCBS use occurred within three months of discharge.<sup>4</sup> Similar to the MFP population, we defined months of HCBS enrollment or use for those who transitioned without MFP starting in the month of the transition to HCBS, and the maximum follow-up was 12 months after the transition date. We then used monthly HCBS enrollment and use data to determine eligibility for the denominator. Using this methodology, a beneficiary could contribute up to 12 person-months to the denominator for the pressure ulcer rates if he or she was enrolled in or using HCBS for all 12 months after the transition.

We imposed several important exclusions to all four populations, in accordance with the specifications developed by AHRQ. 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 Beneficiary Summary File (MBSF). In both cases, if we identified at least one month of managed care enrollment was during the period of interest, the individual was excluded from the measure denominator.

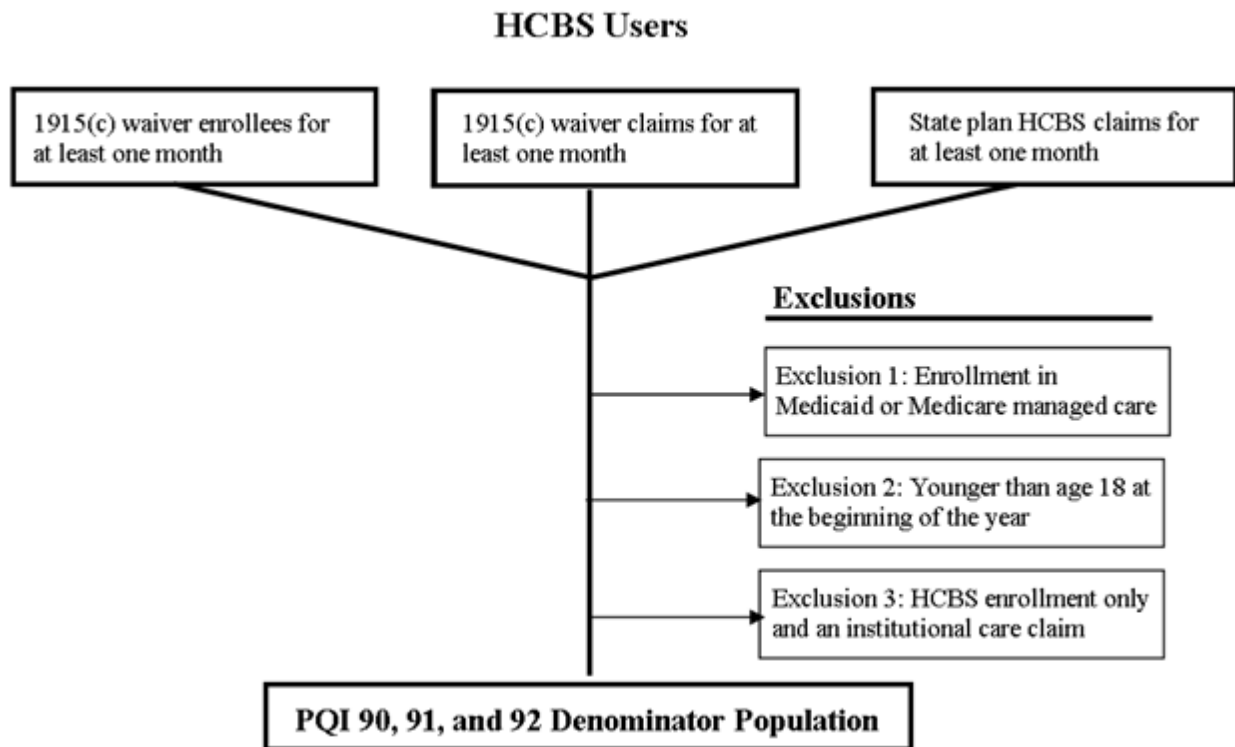
We also excluded children, by limiting the eligible population to people 18 or older (Exclusion 2). We made this decision because children are a population with substantially different care needs and propensity of ambulatory care sensitive condition events than adult HCBS users. Using the MAX PS file, we removed HCBS users who were younger than 18 at the start of the period of interest (for example, January 1, 2009, for the 2009 HCBS population).

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<sup>4</sup> This change was applied to ensure comparability with MFP program requirements. On March 23, 2010, as part of the Affordable Care Act, the criterion for MFP participation was reduced from a minimum of 180 days of institutional care to 90 days, not counting Medicare rehabilitation days. We applied this change as of April 1, 2010 for ease of data processing.

Finally, we excluded 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 (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. 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), we excluded them from the denominator population.

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



Source: Adapted from Schultz E., S. Davies, and K. McDonald. "Development of Quality Indicators for Home and Community-Based Services Population: Technical Report." Stanford, CA: Center for Primary Care and Outcomes Research, June 2012.

## 2. Inpatient stays

Because the HCBS measures identify patient safety events that result in a hospitalization, a necessary step in our calculations required obtaining inpatient hospital stays for everyone in the eligible denominator population. We used monthly indicators for Medicare and Medicaid enrollment to identify MMEs and Medicaid-only beneficiaries. For HCBS users who were enrolled in Medicare and Medicaid, we searched through only Medicare Provider Analysis and Review (MedPAR) claims to identify pressure ulcer events, using the monthly indicators for MME status to determine which months to search the MedPAR claims. For Medicaid-only beneficiaries, we searched the MAX inpatient files, using the monthly indicators for Medicaid-only status to determine which months to search the MAX inpatient files.

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