Centers for Medicare & Medicaid Services
Office of Minority Health (CMS OMH)

The Mapping Medicare Disparities Tool

Technical Documentation

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1. Revisions and Updates to the Technical Documentation

This section summarizes the revisions and updates to the technical documentation for the Mapping Medicare Disparities (MMD) Tool as well as the data presented in the MMD Tool. The MMD Tool is updated frequently. Table 1 summarizes the list of changes or revisions.

Table 1. Revision History for the Mapping Medicare Disparities Tool

Topic	Date	Description
New Data	3/29/2019	• Included four new Opioid Use Disorder (OUD) definitions: Overarching OUD Indicator, Diagnosis- and Procedure-code-based OUD Indicator, Hospitalization and Emergency Room Visits-based OUD Indicator, and Utilization of Medication-Assisted Therapy based OUD Indicator. • Data for CY 2017 are added, increasing the coverage to 2012-2017.
New Feature	3/29/2019	• Developed new menu option to allow for comparison of measure values between urban and rural counties in the state in the Population View. • Added measure descriptions to the Hospital View with hyperlinks that direct users to the detailed measure specification on the Hospital Compare website.
Updated Feature	3/29/2019	• Moved state/county selection for zooming in to the top (above Year and Geography) in the Population View. • In the Hospital View, added a new drop-down menu to display rates at county-level or state-level.
New Data	9/6/18	• Included four new cancer definitions: Breast, Colorectal, Lung, and Prostate for various measures. • Updated Emergency Department visit rates to include condition breakdown. • Added data for CY 2016, increasing the coverage to 2012-2016
New Feature	9/6/18	• Added a hospital-level analysis feature, called Hospital View, to complement the Population View. • Added “State profile” and “national profile” features with socio-economic data from the American Community Survey, U.S. Census Bureau.
New Features	3/23/18	• Made Spanish version of the MMD Tool available. • Created new menu options to allow for comparison of any two sub-populations by age, sex, dual eligibility, and race and ethnicity are added. • Implemented new menu option to select a county of interest within a state is added.
New Data	3/23/18	• Added readmission and mortality rates for CY 2015 are added.
New Data	7/19/2017	• Included chronic diseases, categorized as “Chronic or Potentially Disabling Conditions”, increasing the coverage for chronic diseases. Previously existing conditions are categorized as “Primary Chronic Conditions.” Note that most of the “Chronic or Potentially Disabling Conditions” affect a small share of the study population which can lead to very low prevalence rates or suppressed data in the MMD Tool. Lack of variation across counties or states may also lead to a visualization with a single color. • Added data for CY 2015,increasing the coverage from 2012-2015 except for readmission and mortality rates. Readmission and mortality rates for CY 2015 will be included as soon as the revised methodology is available.

New Data	8/29/2017	• Added uptake (or usage) rates for preventive services are added for 2012-2015.
New Features	7/19/2017	• Added a "trend view" feature with line charts for the selected measure. • Added a "county profile" feature with socio-economic data from the American Community Survey, U.S. Census Bureau.
Revision to Methodology	7/19/2017	• Updated prevalence rates, costs, hospitalization rates, and emergency department visit rates for 2012-2014. They are now based on Chronic Conditions Data Warehouse indicators.[1] Note that data on these measures might have changed (compared to the older versions of the data that was available on the MMD Tool) as a result of this change.
Discontinued Measure(s)	8/29/2017	• Removed Angina without Procedure (PQI 13), one of the Prevention Quality Indicators from the Agency for Healthcare Research and Quality.
Updated Tables	7/19/2017	• Added new tables shifting table numbers compared to the latest version of the documentation. • Content of multiple tables are updated.
Corrections	7/19/2017	• Corrected prevalence rates for Acute Myocardial Infarction and Atrial Fibrillation. Prior to this update, selection of Acute Myocardial Infarction presented values for Atrial Fibrillation, and vice versa. Other measures are not affected.

2. Purpose of the Analysis

2.1 Mapping Medicare Disparities (MMD) Tool - Population View

The Mapping Medicare Disparities (MMD) Tool – Population View is designed to identify areas of disparities between sub-populations (e.g., racial and ethnic groups) in health outcomes, utilization, and spending. This information provides a starting point for understanding health-related data geographically and may be used to target populations for potential interventions. The MMD Tool presents various health-related measures by state/territory county, urban vs. rural counties within a state, age, sex, and dual eligibility status (beneficiaries eligible for both Medicare and Medicaid). The MMD Tool also includes Puerto Rico (at the territory- and county-level) as well as US Virgin Islands, Guam, American Samoa, and Northern Marianas (at the territory-level without county detail). The MMD Tool also offers built-in "analyses" to investigate disparities (1) within counties and across racial and ethnic groups, and (2) within racial and ethnic groups and across counties.

[1] See "Chronic Conditions segment" of the data dictionary for the Medicare Beneficiary Summary File (MBSF) for the descriptions of the chronic condition indicators: https://www.resdac.org/cms-data?tid%5B%5D=6046&tid_1%5B%5D=1&=Find+Data+Files.

2.2 Mapping Medicare Disparities (MMD) Tool - Hospital Tool

The MMD Tool - Hospital View is designed to provide users with a quick and easy way to compare hospitals on quality of care (e.g., readmissions and unplanned hospital visits, safety and patient experience) and cost of care (e.g., Medicare spending). Users can visually analyze a hospital's metrics and performance scores and compare with averages based on: geography (e.g., county, state, and national), hospital type (e.g., acute care and critical access), hospital ownership (e.g., government, physician, proprietary, tribal, and voluntary), and/or hospital size (i.e., number of beds). The Hospital View includes hospitals in U.S. territories, such as Puerto Rico, US Virgin Islands, Guam, American Samoa, and Northern Marianas (at the territory-level without county detail).

3. Data and Analysis

3.1 MMD Tool -- Population View

The data used in this analysis come from the Centers for Medicare & Medicaid Services (CMS) administrative claims for Medicare beneficiaries enrolled in the fee-for-service (FFS) program, which are available from CMS through the Chronic Conditions Warehouse (CCW; www.ccwdata.org/web/guest/home). These claims files are known as CMS Research Identifiable Files (RIF), which consist of the Master Beneficiary Summary File (MBSF) – with beneficiary eligibility, enrollment, beneficiary characteristic data – and final action items for services/claims covered by Medicare Part A (hospital insurance) and Part B (medical insurance). Specifically, CMS RIF used in this analysis include:

- 100% Inpatient RIF
- 100% Skilled Nursing Facility (SNF) RIF
- 100% Hospice RIF
- 100% Home Health Agency RIF
- 100% Outpatient RIF
- 100% Carrier (physician/supplier) RIF
- 100% Durable Medical Equipment (DME) RIF

The methodologies used to calculate hospitalization rates, preventable hospitalizations, readmission rates, and mortality rates require only inpatient claims data (in addition to the MBSF with enrollment information). However, the methodology used to calculate emergency department (ED) visit rates requires both inpatient and outpatient data. The prevalence of chronic conditions and total cost estimates requires all claim types, including Carrier and DME claims.

Included in this analysis are Medicare beneficiaries age 65 years or older, persons under age 65 with certain disabilities, and persons of any age with end stage renal disease (ESRD). We exclude Medicare beneficiaries with any Medicare Advantage enrollment during the year, since claims data are not available for these beneficiaries. Beneficiaries who died during the year are included up to their date of death, if they meet other inclusion criteria. See Appendix A for more details on the population used for each measure.

3.2 MMD Tool -- Hospital View

The data used in the hospital view analysis is sourced from various data sources (e.g., CMS administrative claims for Medicare beneficiaries enrolled in the FFS program, patient surveys), which is available from CMS via the Hospital Compare database.[2] See Appendix B for more details on the data and population used for each measure in the MMD Hospital View.[3]

4. Methodology

4.1 MMD Tool -- Population View

4.1.1 Prevalence Rates and Total Costs

Prevalence rates are calculated by searching for certain diagnosis codes in Medicare beneficiaries' claims. A beneficiary is considered to have a condition if the CMS administrative data has a claim indicating that the beneficiary is diagnosed for a specific condition over the reference time period (one, two, or three years, depending on the condition chosen) or, in the case of ESRD and disability, if the reason for entitlement (original or current) is listed as disabled or ESRD in the MBSF. The prevalence rate of a condition for a specific sub-population (e.g., all beneficiaries in a county) is the proportion of beneficiaries who are found to have the condition. Table 2 shows details of the "main chronic conditions" included in the MMD Tool, while Table 3 shows details of the "other chronic or potentially disabling conditions."

The total costs (i.e., Medicare spending) are annual averages of all costs across all types of claims for beneficiaries with a particular condition (regardless of having or not having other conditions). The risk-adjusted total costs are *expected* total costs based on the CMS Hierarchical Condition Category (HCC) risk adjustment model which provides risk scores at the beneficiary-level.[4] The average risk-adjusted cost for a selected sub-population is the product of the average

[2] Available at: https://www.medicare.gov/hospitalcompare/search.html

[3] Data may not be available for some hospitals due to a limited population of eligible cases.

risk score for the sub-population and the standard total cost of $9,276.26.[5] The standard total cost amount is kept the same for all years to allow for comparisons across years. The principal costs for beneficiaries with a condition are annual averages of all costs across all types of claims with a primary diagnosis associated with that particular condition (regardless of having or not having other conditions). The MMD Tool provides the prevalence rates, total costs, risk-adjusted total costs, and emergency department visits for each of the 60 chronic diseases; and principal costs for each of the 59 chronic conditions (excluding the Opioid User Disorder) as well as for beneficiaries with a disability or ESRD (Table 2) by *beneficiary characteristics* (i.e., every combination of state/territory and county of residence, sex, age group, race and ethnicity, and dual eligibility). CCW developed four Opioid Use Disorder (OUD) indicators. Indicator 1 is an overarching indicator that satisfies the criteria for Indicator 2, Indicator 3 or Indicator 4 that follow. Indicator 2 identifies OUD based on procedure and diagnosis codes. Indicator 3 identifies OUD based on hospitalization and emergency department visits due to opioid-related overdoses and poisoning events. Indicator 4 identifies OUD from the utilization of FDA approved drug for the treatment of MAT such as buprenorphine and naltrexone. All four indicators are available for prevalence rates. Only Indicator 1 is available for total cost, risk adjusted cost, hospitalization, and emergency department visits. Detailed definition of OUD indicators is available at https://www.ccwdata.org/documents/10280/19139421/other-condition-algorithms-and-reference-list-opioids.pdf. See Appendix A for additional details, including the CCW methodology.

Table 2. Data and Definitions Used in the Mapping Medicare Disparities Tool – Chronic Conditions

Measure	Prevalence Rates and Costs	Hospitalization Rates	AHRQ Prevention Quality Indicators (PQIs)	Readmission Rates	Mortality Rates	Emergency Department Visit Rates
Method	Chronic Conditions Data Warehouse (CCW) methodology	Centers for Disease Control and Prevention (CDC) Interactive Atlas methodology or CCW methodology [1]	Agency for Healthcare Research and Quality (AHRQ) methodology	CMS 30-day risk-standardized methodology	CMS 30-day risk-standardized methodology	Research Data Assistance Center (ResDAC) methodology
Condition	• Acute Myocardial Infarction • Alzheimer's Disease, Related Disorders, or Senile Dementia • Asthma • Atrial Fibrillation • Breast Cancer • Cancer (breast, colorectal, lung, and/or prostate) [2] • Chronic Kidney Disease • Chronic Obstructive Pulmonary Disease (COPD) • Colorectal Cancer • Depression [3] • Diabetes • Heart Failure • Hyperlipidemia (high cholesterol) • Hypertension • Ischemic Heart Disease • Lung Cancer • Obesity • Osteoporosis • Prostate Cancer • Rheumatoid Arthritis / Osteoarthritis	• Acute Myocardial Infarction (CDC) • Alzheimer's Disease, Related Disorders, or Senile Dementia (CCW) • Asthma (CCW) • Breast Cancer (CCW) • Cancer (breast, colorectal, lung, and prostate) (CCW) [2] • Cardiac Dysrhythmia (CDC) • Chronic Kidney Disease (CCW) • COPD (CCW) • Colorectal Cancer (CCW) • Depression (CCW) [3] • Diabetes (CCW) • Heart Failure (CDC) • Hyperlipidemia (high cholesterol) (CCW) • Hypertension (CDC) • Ischemic Heart Disease (CDC) • Lung Cancer (CCW) • Obesity (CCW) • Osteoporosis (CCW) • Prostate Cancer (CCW)	• Diabetes Short-term Complications (PQI 01) • Perforated Appendix (PQI 02) • Diabetes Long-term Complications (PQI 03) • COPD or Asthma in Older Adults (PQI 05) • Hypertension (PQI 07) • Heart Failure (PQI 08) • Dehydration (PQI 10) • Bacterial Pneumonia (PQI 11) • Urinary Tract Infection (PQI 12) • Uncontrolled Diabetes (PQI 14) • Lower-Extremity Amputation among Patients with Diabetes (PQI 16) • Prevention Quality Overall Composite (PQI 90) • Prevention Quality Acute Composite (PQI 91)	• Acute Myocardial Infarction • Heart Failure • "All-Cause"	• Acute Myocardial Infarction • Heart Failure	• Acute Myocardial Infarction • Alzheimer's Disease, Related Disorders, or Senile Dementia • Asthma • Atrial Fibrillation • Breast Cancer • Cancer (breast, colorectal, lung, and/or prostate) [2] • Chronic Kidney Disease • Chronic Obstructive Pulmonary Disease (COPD) • Colorectal Cancer • Depression [3] • Diabetes • Heart Failure • Hyperlipidemia (high cholesterol) • Hypertension • Ischemic Heart Disease • Lung Cancer

Measure	Prevalence Rates and Costs	Hospitalization Rates	AHRQ Prevention Quality Indicators (PQIs)	Readmission Rates	Mortality Rates	Emergency Department Visit Rates
	• Schizophrenia/Other Psychotic Disorders • Stroke / Transient Ischemic Attack • 0, 1, 2, or 3+ Conditions [4] • Population-wide [5] • End Stage Renal Disease (ESRD) • Disability	• Rheumatoid Arthritis / Osteoarthritis (CCW) • Schizophrenia/Other Psychotic Disorders (CCW) • Stroke (CDC) • 0, 1, 2, or 3+ Conditions, or "Overall", regardless of the condition specified [6] • ESRD • Disability	• Prevention Quality Chronic Composite (PQI 92)			• Obesity • Osteoporosis • Prostate Cancer • Rheumatoid Arthritis / Osteoarthritis • Schizophrenia/Other Psychotic Disorders • Stroke / Transient Ischemic Attack • 0, 1, 2, or 3+ Conditions, or "Overall", regardless of the condition specified [7] • ESRD • Disability
Data	100% Claims (claim types depending on the condition), except for ESRD and disability which depend on the reason for entitlement from the 100% MBSF	100% Inpatient Claims	100% Inpatient Claims	100% Inpatient Claims	100% Inpatient Claims	100% Inpatient and Outpatient Claims

[1] Listed in the parentheses following each condition under the hospitalization measure is the agency (Centers for Disease Control and Prevention [CDC] or Chronic Condition Date Warehouse [CCW]) whose methodology was used for determining which of the International Classification of Diseases, 9th edition (ICD-9) diagnosis codes (valid until 2015 September), or International Classification of Diseases, 10th edition (ICD-10) diagnosis codes (effective October 1, 2015) are used to calculate hospitalization rates for each condition.
[2] Cancer includes: breast cancer, colorectal cancer, prostate cancer, and lung cancer. An individual having two or more cancers from this list only is identified once as having cancer in our methodology.
[3] Depression differs from the "Depressive Disorder" in Other Chronic or Potentially Disabling Conditions.
[4] Identifies the prevalence rate (i.e., not condition specific) for beneficiaries having 0, 1, 2, or 3 + conditions from the list above.
[5] Only available for costs. It provides the costs (i.e., not condition specific) by demographic variables only, regardless of the number of chronic conditions.
[6] Identifies the hospitalization rate (i.e., not condition specific) for beneficiaries having 0, 1, 2, or 3 + conditions from the list above. Overall hospitalization rate provides the rate by demographic variables only, regardless of the number of chronic conditions.
[7] Identifies the emergency department visit rate (i.e., not condition specific) for beneficiaries having 0, 1, 2, or 3 + conditions from the list above. Overall emergency department visit rate provides the rate by demographic variables only, regardless of the number of chronic conditions.

Table 3. Data and Definitions Used in the Mapping Medicare Disparities Tool – Other Chronic or Potentially Disabling Conditions

Measure	Prevalence Rates, Costs, Hospitalization Rates, and Emergency Department Visit Rates [1]
Other Disabling Condition	**Congenital and Developmental Conditions** [2] ADHD, Conduct Disorders, and Hyperkinetic Syndrome Autism Spectrum Disorders Cerebral Palsy Cystic Fibrosis and Other Metabolic Developmental Disorders Intellectual Disabilities and Related Conditions Learning Disabilities **Liver Conditions** [2] Liver Disease, Cirrhosis and Other Liver Conditions Viral Hepatitis (General) **Mental Health and Substance Use Conditions** [2] Anxiety Disorders Bipolar Disorder Depressive Disorders Post-Traumatic Stress Disorder (PTSD) Personality Disorders Schizophrenia/Other Psychotic Disorders [3] Tobacco Use Opioid Use Disorder (OUD): Overarching OUD Indicator, Diagnosis- and Procedure-code-based OUD Indicator, Hospitalization and Emergency Room Visits-based OUD Indicator, and Utilization of Medication-Assisted Therapy based OUD Indicator [4] **Mobility Limitations and Chronic Pain Conditions** [2] Fibromyalgia, Chronic Pain and Fatigue Multiple Sclerosis and Transverse Myelitis Mobility Impairments Muscular Dystrophy **Neurological Conditions** [2] Epilepsy Migraine and Chronic Headache Spina Bifida and Other Congenital Anomalies of the Nervous System

Measure	Prevalence Rates, Costs, Hospitalization Rates, and Emergency Department Visit Rates [1]
	Spinal Cord Injury Traumatic Brain Injury and Nonpsychotic Mental Disorders due to Brain Damage **Other Chronic or Disabling Conditions** [2] Human Immunodeficiency Virus and/or Acquired Immunodeficiency Syndrome (HIV/AIDS) Leukemias and Lymphomas Obesity [3] Peripheral Vascular Disease (PVD) Pressure and Chronic Ulcers Sensory - Blindness and Visual Impairment Sensory - Deafness and Hearing Impairment **Other Developmental Delays**

[1] All measures are based on CCW methodology: https://www.ccwdata.org/web/guest/condition-categories. Prevalence rates and costs are based on 100% of claims (claim types depending on the condition) while hospitalization rates are based on 100% of inpatient claims.
[2] The six bolded conditions provide overall rates and costs for the conditions that are listed.
[3] "Schizophrenia/Other Psychotic disorders" shown in Table 2 is included in the calculation of prevalence rates, costs, and hospitalization rates for "Mental Health and Substance Use Conditions." Similarly, obesity shown in Table 2 is included in the calculation of prevalence rates, costs, and hospitalization rates for "Other Chronic or Disabling Conditions."
[4] CCW developed four Opioid Use Disorder (OUD) indicators. Indicator 1 is an overarching indicator that satisfies the criteria for Indicator 2, Indicator 3 or Indicator 4 that follow. Indicator 2 identifies OUD based on procedure and diagnosis codes. Indicator 3 identifies OUD based on hospitalization and emergency department visits due to opioid-related overdoses and poisoning events. Indicator 4 identifies OUD from the utilization of FDA approved drug for the treatment of MAT such as buprenorphine and naltrexone. All four indicators are available for prevalence rates. Only Indicator 1 is available for total cost, risk adjusted cost, hospitalization, and emergency department visits. Detailed definition of OUD indicators is available at https://www.ccwdata.org/documents/10280/19139421/other-condition-algorithms-and-reference-list-opioids.pdf.

4.1.2 Hospitalization Rates

The hospitalization rate is the frequency of inpatient hospital discharges in a given year per 1,000 beneficiaries. The Population View of the MMD Tool provides the hospitalization rates for 60 chronic diseases as well as for beneficiaries that have a disability or ESRD (Tables 2-3) by *beneficiary characteristics* (i.e., every combination of state/territory and county of residence, sex, age group, race and ethnicity, and dual eligibility). The hospitalization rates for cardiovascular diseases are calculated using the Center for Disease Control and Prevention (CDC) methodology (i.e., list of diagnosis codes) for consistency with the CDC's Interactive Atlas of Heart Disease and Stroke.[6] The hospitalization rates for opioid use disorder are based on the overarching OUD indicator from CCW. The hospitalization rates for the remaining chronic conditions are based on the diagnosis codes from CCW. See Appendix A.2.2 for a side-by-side comparison of the CDC and CCW methodologies for cardiovascular diseases.

4.1.3 Preventable Hospitalizations - Agency for Healthcare Research and Quality (AHRQ) Prevention Quality Indicators (PQIs)

Measures of preventable hospitalizations were developed by AHRQ to measure quality of care for "ambulatory care-sensitive conditions," which are defined as conditions for which outpatient care or early intervention can possibly prevent hospitalization, or more severe diseases[7,8] These measures are population based and adjusted for age and sex, but are adopted in the analysis for the Medicare FFS population. The Population View of the MMD Tool includes 14 preventable hospitalizations related to the Medicare FFS population (Table 2) by *beneficiary characteristics* (i.e., every combination of state/territory and county of residence, sex, age group, race and ethnicity, and dual eligibility).[9,10] See Appendix A.2.3 for more details, including the AHRQ PQI methodology.

4.1.4 Readmission Rates

To calculate readmission rates, CMS's risk-standardized 30-day all-cause readmission rate calculation methodology was used (available from QualityNet).[11] This methodology calls for a risk-standardized readmission rate (RSRR), which is derived from the ratio of the number of "predicted" readmissions to the number of "expected" readmissions at a given hospital,

[11] QualityNet."Measure Methodology Reports. Baltimore, MD: Centers for Medicare & Medicaid Services. Accessed January 2015.
https://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier3&cid=1219069855273

multiplied by the national observed readmission rate. The number of predicted readmissions (the numerator) is estimated using a hierarchical logistic regression model. Using this model, it is possible to estimate how much of the variation in hospital readmission rates can be attributed to individual patients' risk factors (i.e., sex, race and ethnicity, and age group) and how much of the variation in hospital readmission rates can be attributed to the hospital where the condition was diagnosed. The Population View of the MMD Tool provides the readmission rates for two cardiovascular diseases—acute myocardial infarction and heart failure (Table 2) by state/territory and county of the hospital, and *beneficiary characteristics* (i.e., every combination of sex, age group, and race and ethnicity).[12] See Appendix A.2.4 for more details, including the CMS readmission rate methodology.

4.1.5 Mortality Rates

To calculate mortality rates, CMS's risk-standardized 30-day all-cause mortality rate calculation methodology was used (available from QualityNet).[13] This methodology calls for a risk-standardized mortality rate (RSMR) which is derived from the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. The number of predicted deaths (the numerator) is estimated using a hierarchical logistic regression model. Using this model, it is possible to estimate how much of the variation in hospital mortality rates can be attributed to individual patients' risk factors (i.e., sex, race and ethnicity, age group, and dual eligibility) and how much of the variation in hospital mortality rates can be attributed to the hospital where the condition was diagnosed. The Population View of the MMD Tool provides the mortality rates for two cardiovascular diseases—acute myocardial infarction and heart failure (Table 2) by state/territory and county of the hospital, and *beneficiary characteristics* (i.e., every combination of sex, age group, and race and ethnicity).[14] See Appendix A.2.5 for more details, including the CMS mortality rate methodology.

4.1.6 Emergency Department Visit Rates

The ED visit rate is the frequency of visits to an emergency department in a given year per 1,000 beneficiaries. This measure includes ED visits from both inpatient and outpatient data regardless of whether the beneficiary is admitted to the hospital. The calculations are based on the inpatient

[12] Because the methodology originally calculates hospital-level measures, these estimates are summarized by the county and state of the hospital's location.

[13] QualityNet. Measure Methodology Reports. Baltimore, MD: Centers for Medicare & Medicaid Services. Accessed January 2015. https://www.qualitynet.org/dcs/ContentServer?cid=1163010421830&pagename=QnetPublic%2FPage%2FQnetTier4&c=Page

[14] Because the methodology originally calculates hospital-level measures, these estimates are summarized by the county and state of the hospital's location.

and outpatient files. The Population View of the MMD Tool provides the ED visit rates for 60 chronic diseases, including the new overarching Opioid Use Disorder (OUD) indicator, as well as for beneficiaries that have a disability or ESRD by *beneficiary characteristics* (i.e., every combination of state/territory and county of residence, sex, age group, race and ethnicity, and dual eligibility). See Appendix A.2.6 for more details on the methodology based on guidance from the Research Data Assistance Center (ResDAC).[15]

4.1.7 Preventive Services Uptake Rates

The uptake (or usage) rates for preventive services represent how often Medicare beneficiaries utilize preventive services (i.e., percentage of population) such as screenings, tests, exams, and immunizations. The calculations are based on the inpatient, outpatient, and carrier files. The uptake rates are calculated for 27 specific services that are covered by Medicare.[16] The Population View of the MMD Tool provides the update rates by *beneficiary characteristics* (i.e., every combination of state/territory and county of residence, sex, age group, race and ethnicity, and dual eligibility). Table 4 shows the list of services and included Healthcare Common Procedure Coding System (HCPCS) / Current Procedural Terminology (CPT) codes. See Appendix A.2.7 for more details on the methodology.

Table 4. Definitions Used in the Mapping Medicare Disparities Tool – Preventive Services

Preventive Service	CPT/HCPCS Codes	Additional Criteria
Alcohol Misuse Screening & Counseling	G0442, G0443	
Annual Wellness Visit	G0438, G0439, 99497, 99498	Services limited to beneficiaries no longer in the first 12 months of Medicare enrollment.
Bone Mass Measurement	G0130, 77078, 77080, 77081, 76977	
Cardiovascular Disease Screening	80061, 82465, 83718, 84478	
Colorectal Cancer Screening	G0464, G0104, G0105, G0106, G0120, G0121, 82270, 81528, G0328	Services limited to beneficiaries aged 50 or older.
Counseling to Prevent Tobacco Use	G0436, G0437	
Depression Screening	G0444	
Diabetes Screening	82947, 82950, 82951	

[16] Available at: https://www.cms.gov/Medicare/Prevention/PrevntionGenInfo/medicare-preventive-services/MPS-QuickReferenceChart-1.html

Preventive Service	CPT/HCPCS Codes	Additional Criteria
Diabetes Self-Management Training (DSMT)	G0108, G0109	
Glaucoma Screening	G0117, G0118	
Hepatitis B Vaccine	90739, 90740, 90743, 90744, 90746, 90747, G0010	
Hepatitis C Screening	G0472	
HIV Screening	G0432, G0433, G0435, G0475, 80081	
Influenza Virus Vaccine	90630, 90653, 90654, 90655, 90656, 90657, 90660, 90661, 90662, 90672, 90673, 90674, 90685, 90686, 90687, 90688, Q2035, Q2036, Q2037, Q2038, Q2039, G0008	
Initial Preventive Physical Examination (IPPE)	G0402, G0403, G0404, G0405	Services limited to new beneficiary during the first 12 months of Medicare enrollment
Intensive Behavioral Therapy (IBT) for Cardiovascular Disease (CVD)	G0446	
Intensive Behavioral Therapy (IBT) for Obesity	G0447, G0473	
Lung Cancer Screening Counseling and Annual Screening for Lung Cancer With Low Dose Computed Tomography (LDCT)	G0296, G0297	
Medical Nutrition Therapy (MNT) Services	97802, 97803, 97804, G0270, G0271	
Pneumococcal Vaccine	90670, 90732, G0009	
Prostate Cancer Screening	G0102, G0103	Services limited to men aged 50 or older.
Screening for Cervical Cancer with Human Papillomavirus (HPV) Tests	G0476	Services limited to female aged between 30 and 65
Screening for Sexually Transmitted Infections (STIs) and High Intensity Behavioral Counseling (HIBC) to Prevent STIs	86631, 86632, 87110, 87270, 87320, 87490, 87491, 87810, 87800, 87590, 87591, 87850, 86592, 86593, 86780, 87340, 87341, G0445	
Screening Mammography	77052, 77057, 77063, G0202	Services limited to women aged 35 or older.
Screening Pap Test	G0123, G0124, G0141, G0143, G0144, G0145, G0147, G0148, P3000, P3001, Q0091	Services limited to women.
Screening Pelvic Examination	G0101	Services limited to women.

Preventive Service	CPT/HCPCS Codes	Additional Criteria
Ultrasound Screening for Abdominal Aortic Aneurysm (AAA)	G0389	

Note: The same list of HCPCS/CPT codes are used across 2012-2016 See the CMS Medicare preventive services quick reference guide for descriptions of the services and HCPCS/CPT codes: https://www.cms.gov/Medicare/Prevention/PrevntionGenInfo/medicare-preventive-services/MPS-QuickReferenceChart-1.html

4.2 MMD Hospital View

Table 5 provides a comprehensive list of all domains, subdomains and measures of the Hospital View of the MMD Tool.

Table 5. Definitions Used in the Mapping Medicare Disparities Tool – Hospital View

Domain	Sub-domain	Measures
Readmissions[17]	Readmissions	• Acute Myocardial Infarction (AMI) 30-Day Readmission Rate • Coronary Artery Bypass Grafting (CABG) 30-Day Readmission Rate • Chronic Obstructive Pulmonary Disease (COPD) 30-Day Readmission Rate • Heart Failure (HF) 30-Day Readmission Rate • Hip/Knee Replacement 30-Day Readmission Rate • Hospital 30-Day Readmission Rate (hospital-wide) • Pneumonia (PN) 30-Day Readmission Rate • Stroke (STK) 30-Day Readmission Rate
	Unplanned Hospital Visits	• Rate of Unplanned Hospital Visits after Colonoscopy (per 1,000 colonoscopies)
Safety	Patient Safety Indicators (PSI)	• PSI 3: Pressure Sores • PSI 4: Death among Patients with serious treatable complications after surgery. • PSI 6: Collapsed lung due to medical treatment • PSI 8: Broken hip from a fall after surgery • PSI 9: Perioperative hemorrhage or Hematoma rate • PSI 10: Postoperative Acute Kidney Injury Requiring Dialysis Rate • PSI 11: Postoperative Respiratory Failure Rate • PSI 12: Serious blood clots after surgery • PSI 13: Blood stream infections after surgery (Sepsis) • PSI 14: Split open wound after surgery on the abdomen or pelvis • PSI 15: Accidental cuts and tears from medical treatment • PSI 90: Serious Complications

[17] All readmission measures are based on a 30-day risk-standardized rate.

Domain	Sub-domain	Measures
	Mortality	• Acute Myocardial Infarction (AMI) 30-Day Mortality Rate • Coronary Artery Bypass Grafting (CABG) 30-Day Mortality Rate • Chronic Obstructive Pulmonary Disease (COPD) 30-Day Mortality Rate • Heart Failure (HF) 30-Day Mortality Rate • Pneumonia (PN) 30-Day Mortality Rate • Stroke (STK) 30-Day Mortality Rate
	Healthcare Associated Infections (HAIs)	Standard Infection Ratios (SIR) for the following: • Central line – associated bloodstream infections (CLABSI) in ICUs and select wards • Central line – associated urinary tract infections (CAUTI) in ICUs and select wards • Surgical site infections (SSI) from colon surgery • Surgical site infections (SSI) from abdominal hysterectomy • Methicillin-resistant Staphylococcus Aureus (MRSA) blood infections • Clostridium difficile (C.diff.) intestinal infections
Medicare Spending	Value of Care	• Value of Care Heart Attack measure • Value of Care Hip/Knee Replacement measure • Value of Care Heart Failure measure • Value of Care Pneumonia Measure
Patient Experience	Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey	• Care transition – star rating • Cleanliness – star rating • Communication about medicines – star rating • Discharge information – star rating • Doctor communication – star rating • Nurse communication – star rating • Overall hospital rating – star rating • Pain management – star rating • Quietness – star rating • Recommended hospital – star rating • Staff responsiveness – star rating • Summary star rating
Hospital Value Based Purchasing (HVBP)	None	Unweighted Scores for each HVBP domain: • Unweighted Normalized Clinical Care Domain Score • Unweighted Normalized Efficiency Domain Score • Unweighted Patient and Caregiver Centered Experience Care/Care Coordination Domain Score • Unweighted Normalized Safety Domain Score Total Performance Score (TPS)[18]

[18] Each unweighted score is equally weighted to calculate the Total Performance Score (TPS).

Domain	Sub-domain	Measures
Inpatient Psychiatric Facility Quality Reporting (IPFQR)	None	• Follow-up after Hospitalization for Mental Illness 7-Days • Follow-up after Hospitalization for Mental Illness 30-Days • Hours of physical restraint use • Hours of seclusion • Patients discharged on multiple antipsychotic medications with appropriate justification • Healthcare Personnel Influenza Vaccination • Influenza Immunization • Assessment of Patient Experience of Care • Alcohol Use Screening • Alcohol Use Brief Intervention Provided or Offered • Alcohol Use Brief Intervention • Tobacco Use Screening • Tobacco Use Treatment Provided or Offered (during the hospital stay) • Tobacco Use Treatment (during the hospital stay) • Tobacco Use Treatment Provided or Offered at Discharge • Tobacco Use Treatment at Discharge
Prospective Payment System (PPS) – Exempt Cancer Hospital Quality Reporting (PCHQR)	Oncology Care	• Radiation Dose Limits to Normal Tissues • Plan of Care for Pain – Medical Oncology and Radiation Oncology • Medical and Radiation - Pain Intensity Quantified • Adjuvant Hormonal Therapy for High Risk Prostate Cancer Patients • Avoidance of Overuse Measure - Bone Scan for Staging Low Risk Prostate Cancer Patients
	Cancer Treatment	• Adjuvant Chemotherapy for Colon Cancer • Combination Chemotherapy for Breast Cancer • Hormonal Therapy for Breast Cancer
	External Beam Radiotherapy (ERBT)	• External Beam Radiotherapy for Bone Metastases
	Patient Experience	• Survey star rating for the dimensions in the HCAHPS survey listed in the Patient Experience domain.

4.2.1 Readmission and Unplanned Hospital Visit Rates

The readmission rates represent the CMS's 30-day all-cause risk-standardized readmission rate (RSRR), which is derived from the following calculation:

RSRR = (Predicted Readmission Rate/ Expected Readmission Rate)*National Unadjusted Average Readmission (or Unplanned Hospital Visit) Rate per Condition.[19]

Table 6 provides the national unadjusted readmission rates per condition.

Table 6. National Unadjusted Average Readmission (or Unplanned Hospital Visit) Rate per Condition [20]

Conditions	Rate
Acute Myocardial Infarction (AMI)	16.3%
Coronary Artery Bypass Graft (CABG)	13.8%
Chronic Obstructive Pulmonary Disease (COPD)	19.8%
Heart Failure (HF)	21.6%
Hip/Knee Replacement	4.4%
Pneumonia (PN)	16.9%
Stroke (STK)	12.2%
Colonoscopy (rate of unplanned hospital visits)	16.4%

The number of predicted readmissions is estimated using a hierarchical logistic regression model. Using this model, it is possible to estimate how much of the variation in hospital readmission rates can be attributed to individual patients' risk factors (i.e., sex, race and ethnicity, dual eligibility and age group) and how much of the variation in hospital readmission rates can be attributed to the hospital where the condition was diagnosed.

4.2.2 Patient Safety

There are three subdomains within the safety domain: (1) Patient Safety Indicators (PSI); (2) Healthcare Associated Infections (HAIs); and (3) Mortality.

Patient Safety Indicators (PSI) and Mortality

The PSIs represent the complications that patients experience post-treatment. PSI and mortality subdomains include rates on patient complications and mortalities post-treatment. The PSI and mortality rates are assigned a composite score as an evaluation metric. A composite score is a

[19] The Predicted Readmission Rates and Expected Readmission Rates can be found in the Hospital Readmission Reduction Program (HRRP) dataset in Hospital Compare. These rates are only available for the hospitals that participate in HRRP. Data is collected from July 1, 2013 to June 30, 2016.

[20] The National Unadjusted Readmission Rates per Condition are found in the Unplanned Hospital Visits dataset in Hospital Compare. Data is collected from July 1, 2013 to June 30, 2016.

combination of two or more individual scores in a measure that results in a single score.[21] The measures are based on the AHRQ's PSIs. See Appendix B.2.2 for a list of PSIs.

Healthcare-Associated Infections (HAI)

HAI are infections patients can get while receiving medical treatment in a healthcare facility.[22] These infections are a major, yet often preventable, threat to patient safety.[23] The HAIs in the Hospital View include infection ratios for the following conditions:

- Central line – associated bloodstream infections (CLABSI) in ICUs and select wards;
- Catheter – associated urinary tract infections (CAUTI) in ICUs and select wards;
- Surgical site infections (SSI) for colon surgery;
- Surgical site infections (SSI) hysterectomy procedures;
- Methicillin-resistant Staphylococcus Aureus (MRSA); and
- Clostridium difficile (C.diff) Laboratory – identified events (intestinal infections)

See Appendix B.2.2 for the description of these measures and the methodology used in developing the score.

4.2.3 Medicare Spending

There are four Payment and Value of Care measures within the Medicare spending domain. The Payment and Value of Care measures are included in the MMD Hospital View for these four conditions:

- Heart Attack;
- Hip/Knee Replacement;
- Heart Failure; and
- Pneumonia

[21] National Quality Forum. Composite measure evaluation framework and national voluntary consensus standards for mortality and safety: composite measures. Washington, DC: National Quality Forum; August 2009. Accessed on July 3, 2018. http://www.qualityforum.org/Publications/2009/08/Composite_Measure_Evaluation_Framework_and_National_Voluntary_Consensus_Standards_for_Mortality_and_Safety%E2%80%94Composite_Measures.aspx

[22] https://www.cdc.gov/hai/surveillance/index.html. Centers for Disease Control and Prevention (CDC). Accessed July 3, 2018.

[23] *Ibid.*

The Payment and Value of Care measures provides the average payment and the value of care per condition linking payment to complication and mortality rates. The complication and mortality rates together with Medicare spending serve as a measure for value of care relative to other hospitals.

4.2.4 Patient Experience

The patient experience domain is based on patient survey responses to the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Survey. Patients' responses to the survey are summarized by giving hospitals a star rating (out of five stars) for each dimension of patient experience. See Appendix B.2.3 for a list of patient experience dimensions.

4.2.5 Hospital Value Based Purchasing (HVBP)

The Hospital Value Based Purchasing (HVBP) is an incentive program administered by CMS that rewards hospitals with incentive payments for the quality of care of its Medicare beneficiaries. Approximately 2,800 hospitals participate in the HVBP program. Under the HVBP program, CMS makes incentive payments to hospitals based on their performance in these domains:

- Clinical Care;
- Efficiency;
- Patient and Caregiver Centered Experience of Care/Care Coordination[24]; and
- Safety

Medicare makes the incentive payments to hospitals based on either:

- How well they perform on each measure compared to other hospitals' performance during a baseline period; or
- How much they improve their performance on each measure compared to their performance during a baseline period.

See Appendix B.2.4 for descriptions of the calculation methodology of the Total Performance Score (TPS), weights, measures and HVBP terms.

[24] Beginning with FY 2019, CMS will rename the "Patient and Caregiver-Centered Experience of Care/Care Coordination" domain to "Person and Community Engagement." Source: https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/Hospital_VBPurchasing_Fact_Sheet_ICN907664.pdf

4.2.6 Inpatient Psychiatric Facility Quality Reporting (IPFQR)

The Inpatient Psychiatric Facility Quality (IPFQR) Program provides data on quality measures that aim to assess and foster improvement in the quality of care provided to patients with mental illness.[25] See Appendix B.2.5 for a list of IPFQR measures.

4.2.7 Prospective Payment System (PPS) – Exempt Cancer Hospital Quality Reporting (PCHQR)

The eleven hospitals that are designated as Prospective Payment System (PPS) – Exempt Cancer Hospitals (PCHs) under section (1886)(d)(1)(B)(v) of the Social Security Act are excluded from payment under the Inpatient Prospective Payment System (IPPS).[26] PCHQR was established under section 3005 the Affordable Care Act (ACA) to encourage hospitals and clinicians to improve the quality of inpatient care provided to Medicare beneficiaries by ensuring that providers are aware of and reporting on best practices for their respective facilities and type of care.[27] See Appendix B.2.6 for a list of PCHQR measures.

5. Analysis of Measures by the Number of Chronic Conditions in the Population View

Based on 18 chronic conditions (see Table 2) investigated in the MMD Tool (Acute Myocardial Infarction, Alzheimer's Disease, Related Disorders, or Senile Dementia, Asthma, Atrial Fibrillation, Cancer, Chronic Kidney Disease, Chronic Obstructive Pulmonary Disease (COPD), Depression, Diabetes, Heart Failure, Hyperlipidemia (high cholesterol), Hypertension, Ischemic Heart Disease, Obesity, Osteoporosis, Rheumatoid Arthritis / Osteoarthritis, Schizophrenia/Other Psychotic Disorders, and Stroke / Transient Ischemic Attack), a categorical variable is computed depicting the total number of conditions for each beneficiary: no condition, one condition, two conditions, and three or more conditions. Having a disability or ESRD is excluded from this calculation and analysis. "Other chronic or potentially disabling conditions" (see Table 3) are also excluded from this calculation and analysis. The MMD Tool provides the number of conditions by *beneficiary characteristics* (i.e., every combination of state/territory and county of residence, sex, age group, race and ethnicity, and dual eligibility). Prevalence, hospitalization, and ED rates, as well as total costs can be investigated by these categories. See Appendix A.2.7 for more details on the methodology used to determine multiple chronic conditions.

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[25] https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/IPFQR.html. Accessed on July 3, 2018.

[26] https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/PCHQR.html. Accessed on July 3, 2018.

[27] *Ibid.*

6. Age Standardization of Measures in the Population View

In addition to providing actual rates for each measure, the MMD Tool allows for the selection of age-adjusted rates. Through selecting this option, the MMD Tool will age-standardize each measure by applying a weight to each age group's rate, based on the national age distribution of the selected measure's Medicare population. This approach allows for the comparison of rates between regions (e.g., state/territory or county) with different age distributions. See Appendix A for more details on the methodology used to age standardize the measures.

7. Spatial Smoothing of Measures in the Population View

The MMD Tool also provides spatially smoothed versions of all but cost-related measures. Spatial smoothing can help both with reducing the random noise in the data and the amount of suppression by increasing cell sizes. Referred to as *shrinking estimation*, the basic notion is that smoothed estimates for each geographic area "borrow strength" (or precision) from data in other areas, by an amount dependent on the precision of the raw estimate of each area. For example, a prevalence rate in area X (i.e., county in the MMD Tool) is adjusted by combining the prevalence rate in area X and the prevalence rates in the surrounding area (i.e., neighboring counties). For additional details, please refer to Marshall (1991).[28]

The MMD Tool does not provide smoothed measures for US Virgin Islands, Guam, Northern Marianas, and American Samoa, as county-level data for these territories are not available in the MMD Tool.

8. Analysis Population in the Population View

The MMD Tool displays the analysis population used for each measure within *beneficiary characteristics* (i.e., every combination of state/territory and county of residence, sex, age group, race and ethnicity, and, where applicable, dual eligibility) in the following categories:

- 11-499; 500-999; 1,000-4,999; 5,000-9,999; and 10,000+

If the population size for a sub-population, given by a particular combination of beneficiary characteristics, is less than 11, the measure for this sub-population is not presented in the MMD Tool. See next section for more details on suppression.

[28] Marshall, RJ. Mapping disease and mortality rates using empirical Bayes estimators. *Journal of the Royal Statistical Society. Series C (Applied Statistics)*, 1991; 40(2):283-294.

Because the readmission and mortality rates are based on index admissions instead of the number of beneficiaries, the MMD Tool does not provide the analysis population categories for readmission and mortality rates.

9. Suppression in the Population View

To maintain beneficiary confidentiality and privacy, the underlying data is not individually identifiable health information in the sense of the Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule. With the exception of mortality and readmission measures, suppression is applied as follows:

- A cell (as denoted by a combination of the demographic variables) must have at least eleven (11) individuals, which is the value of the denominator, otherwise this cell is omitted completely from the MMD Tool.
- Instead of the actual values of the denominator, the following five (5) categories are shown for the denominator: (11 – 499; 500 – 999; 1,000 – 4,999; 5, 000 – 9, 999; ≥ 10, 000).
- When percentages are reported - any percentage where fewer than three but greater than zero individuals comprise the underlying numerator, the percentage is set to zero percent. Any corresponding dollar variables are made missing.

10. Utilizing the MMD Tool

10.1 Population View

The MMD Tool allows users to build queries step-by-step. First, a user must select either a state/territory- or county-level option and second, the measure of interest, the domain followed one of the 60 chronic conditions. Then, following Step 4 below, the user can begin to filter results by beneficiary characteristics or leave one or more of the tabs untouched, which defaults to "All." Note that when viewing results, the legend will vary depending on the selection of filters chosen. The intrinsically dynamic legend displays relative rankings rather than fixing legend boundaries, and the rankings are re-computed for each set of filters by aggregating the results for a specific query and dividing the data into 10 equal groups (deciles). This is done to account for the variation of data displayed in the map. Here are the basic steps in building a query:

Step 1. Select the year for your query.

- Choose between 2012, 2013, 2014, 2015, 2016, or 2017 in the **Year** tab.

Step 2 Select the focus of your query.

- Choose between the state/territory-level or county-level option in the **Geography** tab.

Step 3. Select the measure.

- Choose between nine measures (prevalence rates, risk-adjusted total costs, total costs, principle costs, PQIs, hospitalizations, readmission rates, mortality rates, ED visit rates, and preventive services) in the **Measure** tab.

Step 4. Select the adjustment method.

- Choose between the adjustment options (actual, age standardized, smoothed, smoothed & standardized) in the **Adjustment** tab.

Step 4. Select the domain.

- Choose between the primary chronic conditions and chronic or potentially disabling conditions in the **Domain** tab.[29]

Step 5. Select the condition/service.

- For all selections other than preventive services in the **Measure** tab, choose one of chronic conditions in the **Condition/Service** tab. A user may not select more than one condition for review at a time.
- For preventive services in the Measure tab, choose one of the preventive services in the **Condition/Service** tab.

Step 6. Select patient characteristics.

The MMD Tool allows a user to filter by beneficiary characteristic:

- Choose between male and female in the **Sex** tab.
- Choose between four age groups (under 65, 65-74, 75-84, 85 and older) in the **Age** tab.
- Choose between Medicare only and dual eligible in the **Dual Eligibility** tab.
- Choose between seven racial and ethnic groups (All, White, Black, Asian/Pacific Islander, Other, Hispanic, American Indian/Alaska Native) in the **Race and Ethnicity** tab.

Step 7. Select the analysis.

- Choose between five analyses (base measure, within county race and ethnicity differences, difference from state/territory average, difference between rural and urban counties in a state, and difference from national average) in the **Analysis** tab.

[29] When preventive services are selected from the Measure tab, selection from the Domain tab is disabled.

Step 8. Select a comparison sex, age, eligibility status, or race and ethnicity.

- If an option other than base measure is chosen in the **Analysis** tab (within county race differences, difference from state/territory average, difference between rural and urban counties in a state, difference from national average), you may compare one population to another by sex, age, eligibility status, or race and ethnicity. Choose to compare data between two sex categories (male or female) with the **Comparison Sex** tab. Select one of four age groups (<65, 65-74, 74-84, 85+) in the **Comparison Age** tab, eligibility (dual and non-dual, Medicare only, dual only) in the **Comparison Dual Eligible** tab, or seven different racial and ethnic groups (All, White, Black, Asian/Pacific Islander, Other, Hispanic, Native American/Alaska Native) in the **Comparison Race and Ethnicity** tab. Note that the **Comparison** options will not be available for selection if the **Base Measure** of the **Analysis** tab is queried.

This option allows users to examine:

- Disparities (or differences) between different groups within a county
- Disparities (or differences) between different groups in a given county and the national average of a comparison racial and ethnic group
- Disparities (or differences) between different groups in a given county and the state/territory average of a comparison racial and ethnic group
- Disparities (or differences) between different groups in urban counties and rural counties in a state
- Differences in disparities between different groups at the county-level and the disparities for the same or different groups at the state/territory-level

To better understand the significance of the disparities, the Population View provides information on the total population from which the statistics are computed, as well as the statistics themselves. It also takes into account user selections, determines the size of the population of interest, and computes the specified rates or values.

10.2 Hospital View

The Hospital View allows users to build queries step-by-step. First, a user must select either a state/territory and/or county-level option. Second, the hospital of interest. Third, the measure domain and measure subdomains. Here are the basic steps in building a query:

Step 1. Select the State or County.

- Choose any state/territory and/or county from the **State** and/or **County** drop-down menus. *Note: selecting a state automatically filters the list of counties and hospitals to options within*

the state. Subsequently selecting a county further filters the list of hospitals to only those within the selected county.

Step 2. Select the hospital

- Choose any hospital that is located in the state/territory and/or county selected in Step 1 from the **Hospital** drop-down menu.

Step 3. Select the Measure Domain

- Choose among the domains: Avoidable Hospital Utilization, Patient Safety, Medicare Spending, or Patient Experience.

Step 4. Select Measure Sub-Domain

- Choose a measure subdomain based on the Measure Domain selected.

Step 5. Select the condition.

- Choose one of chronic conditions in the **Condition for Map View** tab. A user may not select more than one condition for review at a time. *Note: the condition selected in this menu is used to color-code the geographic visualization, and is also highlighted in the comparison chart in orange.*

Step 6. Select the Comparison(s).

Choose a group of hospitals to compare to the selected hospital by making selections in the Geographic, Hospital Type, and Hospital Size Comparison Group drop-down menus. The default comparison group, if no menu entries are changed, is all hospitals in the Hospital Compare dataset.

With the new "Map Display County/State" menu, users can also choose to display state-level or county-level measures on the map.

11. Other Features of the MMD Tool

11.1 Population View

Trend View: The Population View allows users to analyze trends for all health measures. By clicking on a county, and then selecting "Trend View", users can view line charts for the selected metric together with state and national benchmarks. This view also allows users to download the resulting image to their computers.

County/State/National Profile View: From the U.S. Census Bureau, the MMD Tool provides a list of socio-economic variables for each county, state and nation including: median household income, employment by household size, unemployment rate, percent below the poverty level, percentage of vacant housing units, and the language literacy rate. By clicking on a county, and then selecting either "County Profile View", "State Profile View, or "National Profile View", users can view these socio-economic variables for the selected county, the state that the county is located and nation. If the "Geography" selection is set to "State", only the "State Profile View" and "National Profile View" are available. The socio-economic variables are not specific to the Medicare population, but some variables include data for individuals that are 65 or older. Note that the information presented in the County State, and National Profile views are independent of the selections made by users from the menu options and the resulting queries. See Appendix A for more details on the socio-economic data available in the MMD Tool.

Download Data: The Population View allows users to download the queried data, in addition to the categorized denominator values (i.e., population size) and urban/rural indicator for counties and states, via the "Download Data" button below the query tabs on the left hand side. This feature allows users to save the data on their computers in .csv format.

Download Map: The Population View allows users to download the image for the queried data via the "Download Map" button below the query tabs on the left hand side. This feature allows users to save the image on their computers in .png format.

Download County/State/National Profile Data: The Population View allows users to download the county/state/national profile data via the "Download County/State/National Profile Data" button below the query tabs on the left hand side. This feature allows users to save the data on their computers in .csv format.

11.2 Hospital View

Hospital versus Comparison Group Average View: The Hospital View allows users to observe hospital performance compared to a comparison group average (e.g, a peer group selected by geography, hospital type, and hospital size). The Hospital View generates charts and graphs that will have data points for hospital performance and the selected comparison group's average measure value. This view also allows users to download the resulting image to their computers.

Download Data: The Hospital View allows users to download the queried data via the "Download Hospital Subdomain Data" button below the query tabs on the left hand side. This feature allows users to save the data on their computers in .csv format. The data download is for the selected subdomain, includes all measures within the subdomain, and provides measure values for the selected hospital and comparison group.

Download Map: The Hospital View allows users to download the image for the queried data via the "Download Map" button below the query tabs on the left hand side. This feature allows users to save the image on their computers in .png format.

Appendix A: Expanded Data and Methodology – Population View

A.1 Data

The MMD Tool uses 2012 through 2017 CMS administrative claims data for Medicare beneficiaries enrolled in the FFS program, which are available from CMS through the CCW.[30] These claims files are known as CMS RIFs, which consist of:

- 100% Inpatient RIF with claims from inpatient hospital providers
- 100% Skilled Nursing Facility (SNF) RIF with claims from SNF providers
- 100% Hospice RIF with claims from hospice providers
- 100% Home Health Agency (HHA) RIF with claims from HHA providers
- 100% Outpatient RIF with claims from institutional providers
- 100% Carrier RIF (also known as the Physician/Supplier Part B File) with claims from non-institutional providers
- 100% Durable Medical Equipment (DME) RIF with claims from DME suppliers

The following beneficiary characteristics from the MBSF[31] are available to generate stratified analyses:

- State/territory: State/territory of residence of the beneficiary
- County: County of residence of the beneficiary
- Age: Age of the beneficiary at the end of the prior year
- Sex: Sex of the beneficiary
- Dual eligibility: Beneficiaries eligible for both Medicare and Medicaid regardless of the level of assistance from the state/territory[32]
- Race and ethnicity: Race or ethnicity of the beneficiary[33]

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[30] See www.ccwdata.org. Data dictionaries for CMS RIFs can be found at www.resdac.org.

[31] The data dictionary is available at: https://ccwdata.org/web/guest/data-dictionaries

[32] Research Data Assistance Center (ResDAC). Identifying Dual Eligible Medicare Beneficiaries in the Medicare Beneficiary Enrollment Files. Minneapolis, MN: ResDAC. May 17, 2012. http://www.resdac.org/resconnect/articles/149

[33] Specifically, this is the RTI_RACE_CD variable in the MBSF. A Medicare beneficiary's race and ethnicity is based on the variable imputed race definition created by the Research Triangle Institute (RTI). RTI's race definition improves on the Social Security Administration classification of a beneficiary's race and ethnicity which is designated at birth. The RTI race variable

A.2 Expanded Methodology

A.2.1 Prevalence Rates and Total Costs

The chronic conditions are identified using the Internal Classification of Diseases, 9th edition, (ICD-9) diagnosis codes for claims with service dates before October 1, 2015, and the Internal Classification of Diseases, 10th edition, (ICD-10) diagnosis codes for claims with service dates on or after October 1, 2015, that are present in the Medicare administrative claims.[34,35] A beneficiary is considered to have a chronic condition if there exists a claim indicating that he/she is receiving a service or treatment related to the specific condition.

The analysis population for calculating the prevalence rates and total costs for chronic conditions is 100 of percent of Medicare beneficiaries continuously enrolled in Medicare FFS Parts A and B for the selected year (i.e., 2012, 2013, 2014, 2015, 2016, or 2017), as is the analysis population for calculating the total costs for beneficiaries who have a disability or ESRD. Additionally, beneficiaries who died during the year but otherwise were continuously enrolled up until the date of death, as well as beneficiaries who became eligible for enrollment following the first of the year but were continuously enrolled from that date to the end of the year, are included in the analysis population. Excluded from the analysis are beneficiaries who were enrolled at any point during the year in a Medicare Advantage (MA) plan. Table A.1 presents how the population used to calculate this measure is derived at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017.

Table A.1. Deriving Analysis Population for Prevalence Rates of Chronic Conditions and Total Costs of Chronic Conditions and End Stage Renal Disease and Disability

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[36]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808

imputes race for Hispanic and Asian/Pacific Islander classifications based on Census surname lists for Hispanic and Asian/Pacific Islander origin, as well as geography. The race and ethnicity classifications are: Non-Hispanic White, Black or African American, Asian/Pacific Islander, Hispanic, and American Indian/Alaska Native.

[34] ICD-9 and ICD-10 diagnosis codes are sets of codes used by physicians, hospitals, and allied health workers to indicate diagnosis for all patient encounters in order to improve statistical tracking of diseases.

[35] On October 1, 2015 the conversion from the 9th version of the International Classification of Diseases (ICD-9-CM) to version 10 (ICD-10-CM) occurred. Regardless of when a claim was submitted for payment, services that occurred prior to October 1, 2015, use ICD-9 codes. Chronic conditions identified in 2015 are based upon ICD-9 codes for the first ¾ of the year (January-September) and ICD-10 codes for the last quarter of the year (October-December). For more information, see:

https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Chronic-Conditions/index.html

[36] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Exclude Beneficiaries without Continuous Enrollment in Part A & B throughout Year	(-)	5,008,773	5,168,747	5,294,038	5,447,496	6,437,834	6,699,957
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,521,816	15,865,941	17,519,876	18,907,145	19,415,638	20,844,854
Total Medicare Beneficiaries Included in Analysis	=	34,066,594	34,242,754	34,047,660	34,061,529	33,965,009	33,706,997

However, the Population View will display the number of Medicare beneficiaries by *beneficiary characteristics* (i.e., every combination of state/territory and county of residence, sex, age group, dual eligibility and race and ethnicity) using 100 percent of Medicare beneficiaries continuously enrolled in Medicare FFS Parts A and B for the selected year.

Unlike the methodology used to calculate prevalence rates for chronic conditions, the prevalence rates of beneficiaries who have a disability or ESRD are identified using the reason for entitlement (original or current) found in the MBSF. A beneficiary is considered to have a disability or ESRD if either the original or current reason for entitlement includes disability or ESRD.

The analysis population for calculating the prevalence rates of ESRD and disability is the 100 percent of Medicare beneficiaries continuously enrolled in Medicare FFS for the selected year (i.e., 2012, 2013, 2014, 2015, 2016, or 2017). Additionally, beneficiaries who died during the year but otherwise were continuously enrolled up until the date of death, as well as beneficiaries who became eligible for enrollment following the first of the year but were continuously enrolled from that date to the end of the year, are included in this analysis population. Excluded from the analysis are beneficiaries who were enrolled at any point during the year in an MA plan. Table A.2 presents how the population used to calculate prevalence rates for ESRD and disability is derived at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017.

Table A.2. Deriving Analysis Population for Prevalence Rates of End Stage Renal Disease and Disability

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[37]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Continuous Enrollment throughout Year	(-)	50,259	58,035	59,949	58,139	60,154	61,945
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,742,588	16,113,498	17,777,683	19,174,606	19,679,777	21,141,946
Total Medicare Beneficiaries Included in Analysis	=	38,804,336	39,105,909	39,023,942	39,183,425	40,078,550	40,047,917

The total costs are annual averages of all costs across all types of claims for beneficiaries with a particular condition, regardless of having or not having other conditions. The risk-adjusted total costs are *expected* total costs based on the CMS Hierarchical Condition Category (HCC) risk adjustment model which provides risk scores at the beneficiary-level.[38] The average risk-adjusted cost for a selected sub-population is the product of the average risk score for the sub-population and the standard total cost of $9,276.26 that is calculated by CMS.[39] The standard total cost amount is kept the same for all years to allow for comparisons across years. The principal costs for beneficiaries with a condition are annual averages of all costs across all types of claims with a primary diagnosis associated with that particular condition, regardless of having or not having other conditions. Unlike total costs that are based on any diagnosis code on a claim, principal costs are based only on the principal diagnosis on a claim.

[37] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

[38] The CMS HCC model estimates weights (or adjusters) for over 100 diagnostic categories and demographic characteristics (age, gender, etc.) of beneficiaries in a regression model with total costs as the dependent variable. These weights can then be used to calculate a risk score for each beneficiary.

[39] CMS Risk Adjustment 2015 Model Software, V2213.79.L2, Available at:

https://www.cms.gov/Medicare/Health-Plans/MedicareAdvtgSpecRateStats/Risk-Adjustors-Items/Risk2015.html?DLPage=1&DLEntries=10&DLSort=0&DLSortDir=descending

A.2.2 Hospitalization Rates

The hospitalization rate is calculated using the principal diagnosis codes that are present in the Medicare administrative claims, or, in the case of beneficiaries who have a disability or ESRD, using the overall number of hospitalizations for Medicare beneficiaries with a reason for entitlement (original or current) listed as disabled or ESRD in the MBSF. The analysis population includes 100 percent of Medicare beneficiaries continuously enrolled in Medicare FFS Parts A for the selected year (i.e., 2012, 2013, 2014, 2015, 2016, or 2017). Additionally, beneficiaries who died during the year but otherwise were continuously enrolled up until the date of death, as well as beneficiaries who became eligible for enrollment following the first of the year but were continuously enrolled from that date to the end of the year, are included in the analysis population. Excluded from the analysis are beneficiaries who were enrolled at any point during the year in an MA plan. Table A.3 presents how the population used to calculate this measure is derived at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017.

Table A.3. Deriving Analysis Population for Hospitalizations Measure

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[40]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Continuous Enrollment in Part A throughout Year	(-)	448,203	457,644	462,616	472,031	470,499	486,018
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,711,773	16,079,660	17,742,150	19,136,546	19,646,948	21,102,853
Total Medicare Beneficiaries Included in Analysis	=	38,437,207	38,740,138	38,656,808	38,807,593	39,701,034	39,662,937

The hospitalization rates for cardiovascular diseases are calculated using the CDC methodology to provide trend analysis using CDC's Interactive Atlas of Heart Disease and Stroke.[41] Table A.4 provides a side-by-side comparison of the CDC and CCW methodologies for cardiovascular

[40] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

[41] Hospitalization rates for past years can be viewed at: http://nccd.cdc.gov/DHDSPAtlas/viewer.aspxhttps://nccd.cdc.gov/DHDSPAtlas/

diseases. The hospitalization rates for the remaining chronic conditions are based on the diagnosis codes from the CCW.

Table A.4. Centers for Disease Control and Prevention and Chronic Conditions Data Warehouse Specifications

Hospitalization Measures [1]			Prevalence Rates and Total Cost Measures [2]				
Disease Category	**ICD-9 Diagnosis Code**	**ICD-10 Diagnosis Code**	**Disease Category**	**ICD-9 Diagnosis Code**	**ICD-10 Diagnosis Code**	**Reference Time Period**	**Claim Types Used**
Ischemic Heart Disease	410-414, 429.2 [Principal Diagnosis]	I20-I25 [Principal Diagnosis]	Ischemic Heart Disease	410-414 [Any Diagnosis]	I120-I122, I24-I25	2 years	IP, SNF, HHA, HOP, Carrier
Acute Myocardial Infarction	410 [Principal Diagnosis]	I21-I22 [Principal Diagnosis]	Acute Myocardial Infarction	410 [Principal and Second Diagnosis]	I21-I22	1 years	IP
Cardiac Dysrhythmia	427 [Principal Diagnosis]	I47-I49 [Principal Diagnosis]	Atrial Fibrillation	427.31 [Principal and Second Diagnosis]	I48.0, I48.2, I48.91	1 year	IP, HOP, Carrier
Heart Failure	428 [Principal Diagnosis]	I50 [Principal Diagnosis]	Heart Failure	398.91, 402.01, 402.11, 402.91, 404.01, 404.11, 404.91, 404.03, 404.13, 404.93, 428 [Any Diagnosis]	I09.81, I11.0, I13.0, I13.2, I50	2 years	IP, HOP, Carrier
Hypertension	401-405 [Principal Diagnosis]	I10-I15 [Principal Diagnosis]	Hypertension	326.11, 401-405, 437.2 [Any Diagnosis]	H35.031-H35.033, H35.039, I11-I13, I15, I67.4, N26.2	1 year	IP, SNF, HHA, HOP, Carrier
Stroke	430-434, 436-438 [Principal Diagnosis]	I60-I69 [Principal Diagnosis]	Stroke / Transient Ischemic Attack	430, 431, 433-436, 997.02 [Any Diagnosis]	G45.0-G45.2, G45.8-G45.9, G46.0-G46.2, G97.31-G97.32, I60-I61, I63, I66, I67.841, I67.848, I67.89, I97.810, I97.811, I97.820, I97.821	1 year	IP, HOP, Carrier

HHA: Home Health Agency; HOP: Hospice; IP: Inpatient; SNF: Skilled Nursing Facility

[1] Centers for Disease Control and Prevention (CDC). Condition Categories. Division for Heart Disease and Stroke Prevention: Interactive Atlas. Washington, DC: CDC; 2015. https://www.cdc.gov/dhdsp/maps/atlas/data-sources.htm. Given that ICD-10 diagnosis code are not available from CDC, ICD-9 codes are mapped to ICD-10 codes using the CMS ICD-10-CM and General Equivalence Mapping file: https://www.cms.gov/medicare/coding/icd10/2015-icd-10-cm-and-gems.html.

[2] Chronic Conditions Data Warehouse. Condition Categories. Baltimore, MD: Centers for Medicare & Medicaid Services; 2015. https://www.ccwdata.org/web/guest/condition-categories

A.2.3 Preventable Hospitalizations - AHRQ PQIs

The preventable hospitalization rate is calculated using the PQIs from the AHRQ.[42] PQIs are population based and adjusted for age and sex. They are adopted for Medicare FFS beneficiaries by using the Medicare population instead of the entire population. The 14 preventable hospitalizations included in the MMD Tool are: Diabetes Short-term Complications Admission Rate (PQI 01), Perforated Appendix Admission Rate (PQI 02), Diabetes Long-term Complications Admission Rate (PQI 03), Chronic Obstructive Pulmonary Disease (COPD) or Asthma in Older Adults Admission Rate (PQI 05), Hypertension Admission Rate (PQI 07), Heart Failure Admission Rate (PQI 08), Dehydration Admission Rate (PQI 10), Bacterial Pneumonia Admission Rate (PQI 11), Urinary Tract Infection Admission Rate (PQI 12), Uncontrolled Diabetes Admission Rate (PQI 14), Lower-Extremity Amputation among Patients with Diabetes Rate (PQI 16), Prevention Quality Overall Composite (PQI 90), Prevention Quality Acute Composite (PQI 91), and Prevention Quality Chronic Composite (PQI 92). Technical details for each of the 14 preventable hospitalizations included in the MMD Tool can be found on the AHRQ's website.[43] AHRQ's QI SAS 9.3 software was used for the computations.[44]

The analysis population includes 100 percent of Medicare beneficiaries continuously enrolled in Medicare FFS Parts A for the selected year (i.e., 2012, 2013, 2014, 2015, 2016, or 2017). These beneficiaries are 18 years old or older and are enrolled in Medicare Part A.[45] Additionally, beneficiaries who died during the year, but otherwise were continuously enrolled up until the date of death, as well as beneficiaries who became eligible for enrollment following the first of the year, but were continuously enrolled from that date to the end of the year, are included in the analysis population. Excluded from the analysis are beneficiaries who were enrolled at any point during the year in an MA plan. Table A.5 presents how the population used to calculate this measure is derived at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017.

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[42] Agency for Healthcare Research and Quality (AHRQ). Prevention Quality Indicators Overview. Rockville, MD: AHRQ. Accessed January 2015. http://www.qualityindicators.ahrq.gov/modules/pqi_resources.aspx

[43] AHRQ. Prevention Quality Indicators Technical Specifications Versions 4.5 (for ICD-9; May 2013) and 6.0 (for ICD-10; July 2016). Rockville, MD: AHRQ. Available at:

http://www.qualityindicators.ahrq.gov/Modules/PQI_TechSpec.aspx

https://www.qualityindicators.ahrq.gov/Modules/PQI_TechSpec_ICD10_v60.aspx

[44] AHRQ. AHRQ Quality Indicators Software. Rockville, MD: AHRQ. Versions 4.5 (for ICD-9; May 2013) and 6.0 (for ICD-10; September 2016). http://www.qualityindicators.ahrq.gov/Software/Default.aspx

[45] Note that the menu selection for age in the MMD Tool displays "< 65", but beneficiaries younger than 18 are excluded for PQIs.

Note that Angina without Procedure (PQI 13) Admission Rate is not available in the Population View based on an announcement from AHRQ.[46]

Table A.5. Deriving Analysis Population for Prevention Quality Indicator Measure

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[47]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Continuous Enrollment in Part A throughout Year	(-)	448,203	457,644	462,616	472,031	470,499	486,018
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,711,773	16,079,660	17,742,150	19,136,546	19,645,291	21,102,853
Exclude Beneficiaries younger than 18	(-)	2,116	2,053	1,933	1,806	1,657	1,653
Total Medicare Beneficiaries Included in Analysis	=	38,435,091	38,738,085	38,654,875	38,805,787	39,701,034	39,661,284

A.2.4 Readmission Rates

The readmission rate among beneficiaries with an inpatient claim and a principle diagnosis code of acute myocardial infarction (AMI), or heart failure (HF) is calculated using CMS's risk-standardized readmission measures methodology.[48]

The analysis population includes 100 percent of Medicare beneficiaries continuously enrolled in Medicare FFS Parts A for the selected year (i.e., 2012, 2013, 2014, 2015, 2016, or 2017). These beneficiaries are 18 years old or older and are enrolled in Medicare Part A. Additionally, beneficiaries who died during the year but otherwise were continuously enrolled up until the date of death, as well as beneficiaries who became eligible for enrollment following the first of the

[46] See announcement from AHRQ on this subject: https://www.qualityindicators.ahrq.gov/News/PQI13_Retirement_Announcement.pdf

[47] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

[48] QualityNet. Measure Methodology Reports: Readmission Measures. Baltimore, MD: Centers for Medicare & Medicaid Services. Accessed January 2015. https://www.qualitynet.org/dcs/ContentServer?cid=1219069855841&pagename=QnetPublic%2FPage%2FQnetTier4&c=Page

year but were continuously enrolled from that date to the end of the year, are included in the analysis population. Excluded from the analysis are beneficiaries who were enrolled at any point during the year in an MA plan.

The CMS's risk-standardized readmission rate methodology calls for an RSRR, which is derived from the ratio of the number of "predicted" readmissions to the number of "expected" readmissions at a given hospital, multiplied by the national observed readmission rate. Specifically, for each hospital, the numerator of the ratio is the number of readmissions within 30 days predicted on the basis of the hospital's performance with its observed case mix (AMI, HF), and the denominator is the number of readmissions expected on the basis of the nation's performance with that hospital's case mix. The number of predicted readmissions (the numerator) is estimated using a hierarchical logistic regression model. The predicted number of readmissions is calculated by regressing risk factors (for AMI and HF, respectively) and the hospital-specific intercept on the risk of readmission. The estimated regression coefficients are then multiplied by the patient's *beneficiary characteristics* in the hospital. The results are then transformed and summed over all patients attributed to the hospital to get a value. The expected number of readmissions (the denominator) is obtained by regressing the risk factors and a common intercept on the readmission outcome using all hospitals in our sample. The estimated regression coefficients are then multiplied by the patient characteristics in the hospital. The results are then transformed and summed over all patients in the hospital. To assess hospital performance for the analysis period, we then re-estimated the model coefficients using the years of data in that period. This ratio is multiplied by the national rate to calculate the RSRR.[49] These hospital-level rates are then aggregated for each set of beneficiary characteristics for the Population View.

A.2.5 Mortality Rates

The mortality rate among beneficiaries with an inpatient claim and a principle diagnosis code of AMI or HF is calculated using CMS's risk-standardized mortality measures methodology.[50]

The analysis population includes 100 percent of Medicare beneficiaries continuously enrolled in Medicare FFS Parts A for the selected year (i.e., 2012, 2013, 2014, 2015, 2016, or 2017). These beneficiaries are 18 years old or older, and are enrolled in Medicare Part A. Additionally, beneficiaries who died during the year but otherwise were continuously enrolled up until the date of death, as well as beneficiaries who became eligible for enrollment following the first of the

[49] 2015 Condition-Specific Measures Updates and Specifications Report: Hospital-Level 30-Day Risk-Standardized Readmissions Measures (Version 8.0).

[50] QualityNet. Methodology and Updates Reports: Mortality Measures. Baltimore, MD: Centers for Medicare & Medicaid Services. Accessed January 2015. https://www.qualitynet.org/dcs/ContentServer?cid=1163010421830&pagename=QnetPublic%2FPage%2FQnetTier4&c=Page

year but were continuously enrolled from that date to the end of the year, are included in the analysis population. Excluded from the analysis are beneficiaries who were enrolled at any point during the year in an MA plan.

The CMS's risk-standardized mortality rate methodology calls for an RSMR, which is derived from the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. Specifically, for each hospital, the numerator of the ratio is the number of deaths within 30 days predicted on the basis of the hospital's performance with its observed case mix (AMI, HF), and the denominator is the number of deaths expected on the basis of the nation's performance with that hospital's case mix. The number of predicted deaths (the numerator) is estimated using a hierarchical logistic regression model. The predicted number of deaths is calculated by regressing risk factors (for AMI and HF, respectively) and the hospital-specific intercept on the risk of mortality. The estimated regression coefficients are then multiplied by the patient's *beneficiary characteristics* in the hospital. The results are then transformed and summed over all patients attributed to the hospital to get a value. The expected number of deaths (the denominator) is obtained by regressing the risk factors and a common intercept on the mortality outcome using all hospitals in our sample. The estimated regression coefficients are then multiplied by the patient characteristics in the hospital. The results are then transformed and summed over all patients in the hospital. To assess hospital performance for the analysis period, we then re-estimated the model coefficients using the years of data in that period. This ratio is multiplied by the national rate to calculate the RSMR.[51] These hospital-level rates are then aggregated for each set of beneficiary characteristics for the Population View.

A.2.6 Emergency Department Visit Rate

The ED visit rate is calculated using the revenue center codes that are present in the Medicare inpatient and outpatient files. The total number of ED visits a beneficiary had in a year included visits where the beneficiary was released from the outpatient setting and where the beneficiary was admitted to an inpatient setting. The analysis population includes 100 percent of Medicare beneficiaries continuously enrolled in Medicare FFS Parts A and B for the selected year (i.e., 2012, 2013, 2014, 2015, 2016, or 2017). Additionally, beneficiaries who died during the year but otherwise were continuously enrolled up until the date of death, as well as beneficiaries who became eligible for enrollment following the first of the year but were continuously enrolled from that date to the end of the year, are included in the analysis population. Excluded from the analysis are beneficiaries who were enrolled at any point during the year in an MA plan. Table

[51] 2013 Measures Updates and Specifications: Acute Myocardial Infarction, Heart Failure, and Pneumonia 30-Day Risk-Standardized Mortality Measure (Version 7.0).

A.6 presents how the population used to calculate this measure are derived at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017.

Table A.6. Deriving Analysis Population for Emergency Department Visit Measure

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[52]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Continuous Enrollment in Part A & B throughout Year	(-)	5,008,773	5,168,747	5,294,038	5,447,496	6,437,834	6,699,957
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,521,816	15,865,941	17,519,876	18,907,145	19,415,638	20,844,854
Total Medicare Beneficiaries Included in Analysis	=	34,066,594	34,242,754	34,047,660	34,061,529	33,965,009	33,706,997

ED rates are calculated using guidance provided by the ResDAC.[53] Table A.7 provides the list of revenue center codes needed to determine a visit to the ED.

Table A.7. Emergency Department Visit Specifications

Measure	Revenue Center Code	Reference Time Period	Claim Types Used
Emergency Department Visit	0450-0459, 0981 [Any Diagnosis]	1 year	Inpatient, Outpatient

A.2.7. Preventive Services Uptake Rates

The preventive services are identified using the HCPCS/CPT codes that are present in the Medicare administrative claims. The uptake rate for a specific service is calculated as the percentage of beneficiaries that received at least one of the covered services (defined by HCPCS/CPT codes) in a given year.

[52] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

[53] Research Data Assistance Center (ResDAC). How to Identify Hospital Claims for Emergency Room Visits in the Medicare Claims Data. Minneapolis, MN: ResDAC. July 22, 2015.http://www.resdac.org/resconnect/articles/144

The analysis population for calculating the preventive services uptake rates is 100 of percent of Medicare beneficiaries who have at least one month of enrollment in Medicare FFS Part B for the selected year (i.e., 2012, 2013, 2014, 2015, 2016, or 2017). Excluded from the analysis are beneficiaries who were enrolled at any point during the year in a MA plan. The analysis populations for a few preventive services exclude certain age groups and/or sex as detailed below. Tables A.8-A.15 present how the populations used to calculate this measure for preventive services are derived at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017.

Table A.8 presents the derivation of study population for *Annual Wellness Visit* at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017. In addition to the enrollment requirements described above, this service also requires beneficiaries who are no longer within 12 months of Medicare Part B enrollment start date to be excluded.

Table A.8. Deriving Analysis Population for Annual Wellness Visit

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[54]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Part B enrollment for at least one month	(-)	3,604,722	3,691,503	3,763,247	3,848,711	4,821,916	5,011,164
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,687,104	16,023,518	17,647,271	19,007,879	19,483,437	20,903,078
Exclude Beneficiaries within 12 months of enrollment start date	(-)	2,818,427	2,677,001	2,634,522	2,593,229	2,495,460	2,381,722
Total Medicare Beneficiaries Included in Analysis	=	32,486,930	32,885,420	32,816,534	32,966,351	33,017,668	32,955,844

Table A.9 presents the derivation of study population for *Initial Preventive Physical Examination* at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017. In addition to the enrollment requirements described above, this service also requires beneficiaries to be within 12 months of Medicare Part B enrollment start date.

[54] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

Table A.9. Deriving Analysis Population for Initial Preventive Physical Examination

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[55]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Part B enrollment for at least one month	(-)	3,604,722	3,691,503	3,763,247	3,848,711	4,821,916	5,011,164
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,687,104	16,023,518	17,647,271	19,007,879	19,483,437	20,903,078
Exclude Beneficiaries no longer within 12 months of enrollment start date	(-)	32,172,694	32,437,450	32,240,285	32,252,826	32,179,205	31,983,760
Total Medicare Beneficiaries Included in Analysis	=	3,132,663	3,124,971	3,210,771	3,306,754	3,333,923	3,353,806

Table A.10 presents the derivation of study population for *Colorectal Cancer Screening* at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017. In addition to the enrollment requirements described above, this service also requires beneficiaries to be aged 50 or above.

[55] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

Table A.10. Deriving Analysis Population for Colorectal Cancer Screening

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[56]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Part B enrollment for at least one month	(-)	3,604,722	3,691,503	3,763,247	3,848,711	4,821,916	5,011,164
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,687,104	16,023,518	17,647,271	19,007,879	19,483,437	20,903,078
Exclude Beneficiaries aged less than 50	(-)	2,377,889	2,324,194	2,202,803	2,092,591	1,984,802	1,889,176
Total Medicare Beneficiaries Included in Analysis	=	32,927,468	33,238,227	33,248,253	33,466,989	33,528,326	33,448,390

Table A.11 presents the derivation of study population for *Mammogram Screening* at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017. In addition to the enrollment requirements described above, this service also requires beneficiaries to be female and aged 35 or above.

[56] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

Table A.11. Deriving Analysis Population for Mammogram Screening Preventive Services Measure

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[57]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Part B enrollment for at least one month	(-)	3,604,722	3,691,503	3,763,247	3,848,711	4,821,916	5,011,164
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,687,104	16,023,518	17,647,271	19,007,879	19,483,437	20,903,078
Exclude Male Beneficiaries	(-)	15,709,213	15,825,803	15,776,981	15,803,970	15,587,429	15,490,083
Exclude Female Beneficiaries aged less than 35	(-)	285,742	280,525	263,121	246,156	231,041	214,715
Total Medicare Beneficiaries Included in Analysis	=	19,310,402	19,456,093	19,410,954	19,509,454	19,694,658	19,632,768

Table A.12 presents the derivation of study population for *Pap Test Screening and Pelvic Examination Screening* at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017. In addition to the enrollment requirements described above, this service also requires beneficiaries to be female.

[57] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

Table A.12. Deriving Analysis Population for Pap Test Screening and Pelvic Examination Screening

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[58]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Part B enrollment for at least one month	(-)	3,604,722	3,691,503	3,763,247	3,848,711	4,821,916	5,011,164
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,687,104	16,023,518	17,647,271	19,007,879	19,483,437	20,903,078
Exclude Male Beneficiaries	(-)	15,709,213	15,825,803	15,776,981	15,803,970	15,587,429	15,490,083
Total Medicare Beneficiaries Included in Analysis	=	19,596,144	19,736,618	19,674,075	19,755,610	19,925,699	19,847,483

Table A.13 presents the derivation of study population for *Prostate Cancer Screening* at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017. In addition to the enrollment requirements described above, this service also requires beneficiaries to be male and aged 50 or above.

[58] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

Table A.13. Deriving Analysis Population for Prostate Cancer Screening

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[59]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Part B enrollment for at least one month	(-)	3,604,722	3,691,503	3,763,247	3,848,711	4,821,916	5,011,164
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,687,104	16,023,518	17,647,271	19,007,879	19,483,437	20,903,078
Exclude Female Beneficiaries	(-)	19,281,908	19,288,648	19,097,826	19,042,085	19,087,236	18,900,968
Exclude Male Beneficiaries aged less than 50	(-)	1,271,423	1,243,014	1,178,959	1,120,790	1,067,085	1,019,026
Total Medicare Beneficiaries Included in Analysis	=	14,752,026	15,030,759	15,174,271	15,396,705	15,358,807	15,417,572

Table A.14 presents the derivation of study population for *Cervical Cancer with Human Papillomavirus (HPV) Tests Screening* at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017. In addition to the enrollment requirements described above, this service also requires beneficiaries to be female and aged between 30 and 65.

[59] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

Table A.14. Deriving Analysis Population for Cervical Cancer with Human Papillomavirus (HPV) Tests Screening

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[60]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Part B enrollment for at least one month	(-)	3,604,722	3,691,503	3,763,247	3,848,711	4,821,916	5,011,164
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,687,104	16,023,518	17,647,271	19,007,879	19,483,437	20,903,078
Exclude Male Beneficiaries	(-)	15,709,213	15,825,803	15776981	15,803,970	15,587,429	15,490,083
Exclude Female Beneficiaries aged not within 30 to 65	(-)	15,355,428	15,431,035	15,308,940	15,326,315	15,501,488	15,466,984
Total Medicare Beneficiaries Included in Analysis	=	4,240,716	4,305,583	4,365,135	4,429,295	4,424,211	4,380,499

Table A.15 presents the derivation of study population for all other preventive services (without additional age or sex restrictions) at the national level for the years 2012, 2013, 2014, 2015, 2016, and 2017.

[60] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

Table A.15. Deriving Analysis Population for Preventive Services Measure

Steps to Create the Analysis Population	Formula	Number of Beneficiaries					
		2012	2013	2014	2015	2016	2017
Total Medicare Enrollees[61]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808
Exclude Beneficiaries without Part B enrollment for at least one month	(-)	3,604,722	3,691,503	3,763,247	3,848,711	4,821,916	5,011,164
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,687,104	16,023,518	17,647,271	19,007,879	19,483,437	20,903,078
Total Medicare Beneficiaries Included in Analysis	=	35,305,357	35,562,421	35,451,056	35,559,580	35,513,128	35,337,566

A.2.8. Analysis of Measures by the Number of Chronic Conditions

The chronic condition indicators are identified using the ICD-9 or ICD-10 diagnosis codes (depending on the service date on the claim) that are present in the Medicare administrative claims. Based on only the chronic conditions investigated in the Population View (a total of 60 conditions), a categorical variable is computed depicting the total number of conditions for each beneficiary: No condition, one condition, two conditions, and three or more conditions. Having a disability or ESRD is excluded from this calculation and analysis. Additionally, for the purposes of this analysis, a beneficiary having multiple forms of cancer (breast, colorectal, prostate, and lung) would only appear as having one chronic condition in the Population View.

A.2.9 Age Standardization of Measures

In addition to providing un-adjusted rates for each measure, the Population View also allows for the selection of age-adjusted rates. If the age standardized option is selected, the tool will apply a weight to each age group's rate based on the national age group distribution of the selected measure's Medicare population.

For example, to age standardize rates in the prevalence measure, the weights listed in Table A.16 are applied to each age group's rate. These weights are calculated based on the national age group distribution of the analysis population used in the prevalence measure: 100 percent of

[61] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

Medicare beneficiaries continuously enrolled in Medicare FFS Parts A and B for the selected year. There are slight differences in weighting depending on the years and measures selected.

Table A.16. 2012 Age Weights for Prevalence Measure

Age Group	Number of Beneficiaries	Weight
< 65	6,174,269	0.1822
65 - 74	14,215,633	0.4194
75 - 84	8,871,580	0.2617
85 +	4,633,722	0.1367
Overall	33,895,204	1.0000

However, in instances where a region (e.g., state/territory or county) has zero beneficiaries in one or more of the age groups (i.e., under 65, 65-74, 75-84, 85 and older), the weights for each of the region's remaining age groups are recalculated by equally distributing the missing age group's shares to the remaining age groups.

Applying weights based on the national age group distribution of the selected measures' Medicare population allows for the comparison of rates between regions (e.g., state/territory or county) with different age distributions.

A.3 Socio-Economic Data Updates

The socio-economic data within the "County Profile View", "State Profile View", and "National Profile View" of the Population View are based on the ACS data provided by the U.S. Census Bureau for years 2012 through 2015. Socio-economic measures for each county include the following:

- Median Household Income by Household Size: (5-Year Trailing Average)
- Median Household Income: (5-Year Trailing Average)
- Household Size by Number of Workers: (5-Year Trailing Average)
- Poverty Status: (1-Year and 5-Year Trailing Average)
- Senior Poverty Status: (1-Year and 5-Year Trailing Average)
- Vacant Housing: (1-Year and 5-Year Trailing Average)
- English Proficiency: (5-Year Trailing Average)
- Unemployment Rate: (1-Year and 5-Year Trailing Average)
- Senior Unemployment Rate: (1-Year and 5 Year Trailing Average)

Data files for these measures were downloaded from the American Fact Finder website for the U.S. Census Bureau.[62] The different number of years over which the data was averaged correspond to different levels of granularity and the number of counties with available data: Five-year trailing averages produce the most precise and granular estimates at the expense of smoothing the estimates over time. One-year estimates are only conducted for population areas over 65,000 but provide a better "snapshot" of a particular measure in a particular year. More detailed information on ACS questionnaires, sample sizes and data collection methodology are available on the ACS methodology website.[63] After downloading ACS data files some manipulation of certain estimates was required to arrive at the desired measures; descriptions of the estimates used in these calculations are included below:

Table A.17. Calculation of Socio-Economic Measures

Measure	Numerator Description	Denominator Description
Median Household Income by Household Size	Median household income in the past 12 months (in 2012 inflation-adjusted dollars) by household size	
Median Household Income	Median household income in the past 12 months (in 2012 inflation-adjusted dollars)	
Household Size by Number of Workers	Total *X*-person households with *Y*-workers	Total X-person households
Poverty Status	Population with income below poverty level in the past 12 months	Total population for whom poverty status is determined
Senior Poverty Status	Population over 65 with income below poverty level in the past 12 months	Total population for whom poverty status is determined
Vacant Housing	Number of vacant housing units where the housing unit is vacant for reasons other than sale	Total number of housing units
English Proficiency	The sum of all "Speak Only English" responses and other language groups responding "Speaking English Very Well"	Total Population over 5 years of age
Unemployment Rate	The sum of all population age groups 16 years of age and older responding as being in the labor force and unemployed	The sum of all population age groups 16 years of age and older responding as being in the labor force
Senior Unemployment Rate	The sum of all population age groups 65 years of age and older responding as being in the labor force and unemployed	The sum of all population age groups 65 years of age and older responding as being in the labor force

[62] See https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml.

[63] See https://www.census.gov/programs-surveys/acs/methodology.html/.

Appendix B: Expanded Data and Methodology - Hospital View

B.1 Data

The Hospital View is based on the 2013 through 2017 CMS hospital-level claims and survey data for Medicare beneficiaries enrolled in the FFS program, which are available from CMS through the Hospital Compare database.[64]

B.2 Expanded Methodology

B.2.1 Readmission Rates

Please see Appendix A.2.4.

B.2.2 Patient Safety

There are three subdomains within the patient safety domain: (1) Patient Safety Indicators (PSI); (2) Healthcare Associated Infections (HAIs); and (3) Mortality. PSIs and Mortality include scores on patient complications and mortalities post-treatment. Table B.1 provides a list of PSIs as developed by AHRQ.

[64] See Hospital Compare to access raw data files.

Table B.1. List of AHRQ's PSIs

PSIs	Description
PSI 3	Pressure Sores
PSI 4	Death among Patients with serious treatable complications after surgery
PSI 6	Collapsed lung due to medical treatment
PSI 8	Broken hip from a fall after surgery
PSI 9	Perioperative hemorrhage or Hematoma rate
PSI 10	Postoperative Acute Kidney Injury Requiring Dialysis Rate
PSI 11	Postoperative Respiratory Failure Rate
PSI 12	Serious blood clots after surgery
PSI 13	Blood stream infections after surgery (Sepsis)
PSI 14	Split open wound after surgery on the abdomen or pelvis
PSI 15	Accidental cuts and tears from medical treatment
PSI 90	Serious Complications

HAI are infections patients can acquire while receiving medical treatment in a healthcare facility. These infections are a major, yet often preventable, threat to patient safety. The following HAI included in the Hospital View are:

- Central line – associated bloodstream infections (CLABSI) in ICUs and select wards;
- Catheter – associated urinary tract infections (CAUTI) in ICUs and select wards;
- Surgical site infections (SSI) for colon surgery;
- Surgical site infections (SSI) hysterectomy procedures;
- Methicillin-resistant Staphylococcus Aureus (MRSA); and
- Clostridium difficile (C.diff) Laboratory – identified events (intestinal infections)

The HAI measures are based on the Standardized Infection Ratio (SIR). The SIR is a summary measure used to track HAIs at a national, state, or local level over time. The SIR adjusts for

various hospital and/or patient-level factors that contribute to HAI risk within each hospital.[65] The standardized infection ratio (SIR) is calculated by dividing the number of observed events by the number of predicted events.[66] For more information on the SIR, go to CDC SIR Guide.

Mortality measures included are estimates of deaths in the 30 days after the entering the hospital for a specific condition or having Coronary Artery Bypass Graft (CABG) surgery. Deaths can be for any reason, and can occur in the hospital or after discharge. Specific conditions included are: (1) Acute Myocardial Infarction; (2) Coronary Artery Bypass Graft; (3) Chronic Obstructive Pulmonary Disease; (4) Heart Failure; (5) Pneumonia; and (6) Stroke.

B.2.3 Patient Experience

The patient experience domain is based on patient survey responses to the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Survey. Patients' responses to the survey are summarized by giving hospitals a star rating (out of five stars) for each dimension of patient experience. Table B.2 provides a list of patient experience dimensions.

Table B.2. Patient Experience Dimensions

HCAHPS Survey Dimensions of Patient Experience
Care Transition
Cleanliness
Communication about medicines
Discharge information
Doctor and nurse communication
Overall hospital rating
Pain management
Quietness
Recommended hospitals
Staff responsiveness
Summary star rating

[65] Centers for Disease Control and Prevention (CDC). The NHSN Standardized Infection Ratio: A Guide to the SIR, March 2018 Update. Accessed on July 3, 2018. https://www.cdc.gov/nhsn/pdfs/ps-analysis-resources/nhsn-sir-guide.pdf

[66] Centers for Disease Control and Prevention (CDC). National Healthcare Safety Network (NHSN) Patient Safety Component Manual. Accessed on July 3, 2018. https://www.cdc.gov/nhsn/pdfs/pscmanual/pcsmanual_current.pdf

B.2.4 Hospital Value-Based Purchasing (HVBP)[67]

The HVBP program is an incentive program administered by CMS that rewards hospitals with payments for the quality of care of its Medicare beneficiaries. Approximately 2,800 hospitals participate in the HVBP program. Each hospital in the HVBP program is given a Total Performance Score (TPS) based on four dimensions: safety, clinical care, efficiency and cost reduction, and patient and caregiver-centered experience of care/care coordination. The unweighted score for each dimension are equally weighted in the calculation of the TPS.

Table B.3 is a list of measures include in every HVBP domain.

Table B.3. FY 2018 HVBP Measures

Measure ID	Measures	Domain
CAUTI	Catheter-Associated Urinary Tract Infection	Safety
CLABSI	Central Line-Associated Blood Stream Infection	Safety
CDI	Clostridium difficile Infection (C. difficile)	Safety
MRSA	Methicillin-Resistant Staphylococcus aureus Bacteremia	Safety
PSI-90	Patient Safety for Selected Indicators (composite)	Safety
PC-01	Elective Delivery Prior to 39 Completed Weeks Gestation	Safety
SSI	Surgical Site Infection (SSI): ● Colon Surgery ● Abdominal Hysterectomy	Safety
MORT-30-AMI	Acute Myocardial Infarction (AMI) 30-Day Mortality Rate	Clinical Process of Care
MORT-30-HF	Heart Failure (HF) 30-Day Mortality Rate	Clinical Process of Care
MORT-30-PN	Pneumonia (PN) 30-Day Mortality Rate	Clinical Process of Care
MSPB-1	Medicare Spending per Beneficiary (MSPB)	Efficiency and Cost Reduction
	● Communication with Nurses ● Communication with Doctors ● Responsiveness of Hospital Staff ● Communication about Medicines ● Hospital Cleanliness and Quietness ● Discharge Information ● 3-Item Care Transition ● Overall Rating of Hospital	Patient Experience of Care

[67] https://www.cms.gov/Outreach-and-Education/Medicare-Learning-Network-MLN/MLNProducts/downloads/Hospital_VBPurchasing_Fact_Sheet_ICN907664.pdf. Accessed on July 3, 2018.

Baseline and Performance Period

The baseline period is the time period used to establish the performance standards (i.e., thresholds and averages) for a given program year. The hospitals results during the baseline period are compare to the results achieved during the performance period. The performance period is the time period used to identify a hospital's performance rate for a given program year. CMS assessed each hospital's total performance by comparing its Achievement and Improvement scores for each applicable HVBP measure. CMS uses a threshold and average to determine how many points to award for the Achievement and Improvement scores. CMS compares the Achievement and Improvement scores and uses whichever is greater.

Threshold, Average and Points

- **Average**: Average (mean) performance of the top 10 percent of hospitals during baseline period.
- **Achievement Threshold**: Performance at the 50th percentile (median) of hospitals during the baseline period.
- **Achievement Points** are awarded by comparing an individual hospital's rates during the performance period to *all* hospital's rates from the baseline period:
    - Hospital rates at or above Comparison = 10 Achievement points
    - Hospital Rates below the Achievement threshold = 0 Achievement points
    - Hospital's rate is equal to or greater than the Achievement threshold but not less than the comparison = 1 – 9 Achievement points
- **Improvement points** are awarded by comparing an individual hospital's rates during the performance period to that same individual hospital's rates from the baseline period:
    - Hospital rates at or above Comparison = 9 Improvement points
    - Hospital rates at or below baseline period score = 0 Improvement points
    - Hospital's rate is greater than its baseline period score but below Comparison = 0 – 9 Improvement points

- **Consistency points** are awarded by comparing an individual hospital's HCAHPS Survey dimension rates during the performance period to all hospitals' HCAHPS Survey rate from a baseline period:
    - If a hospital's performance on all HCAHPS dimensions is at or above Achievement threshold = 20 Consistency points
    - If any HCAHPS dimension rate is at or below the worst-performing hospital's performance on that dimension during the baseline period = 0 Consistency points
    - If the lowest HCAHPS dimension score is greater than the worst-performing hospital's rate but less than the Achievement threshold = 0 – 20 Consistency points

The Achievement, Improvement and Consistency points are factored into the CMS calculation of the hospital's TPS.

B.2.5 Inpatient Psychiatric Facility Quality Reporting (IPFQR)

The IPFQR Program provides data on quality measures that aim to assess and foster improvement in the quality of care provided to patients with mental illness. Table B.4 provides a list of IPFQR Measures.

Table B.4. List of IPFQR Measures

Measure ID	Measure Description
HBIPS_2	Hours of physical restraint use
HBIPS_3	Hours of seclusion
HBIPS_5	Patients discharged on multiple antipsychotic medications with appropriate justification
SUB_1	Alcohol Use Screening
SUB_2	Alcohol Use Brief Intervention Provided or Offered
SUB_2a	Alcohol Use Brief Intervention
TOB_1	Tobacco Use Screening
TOB_2	Tobacco Use Treatment Provided or Offered (during hospital stay)
TOB_2a	Tobacco Use Treatment (during the hospital stay)
TOB_3	Tobacco Use Treatment Provided or Offered at Discharge
TOB_3a	Tobacco Use Treatment at Discharge
IMM_2	Influenza Immunization
HCP	Healthcare Personnel Influenza Vaccination

B.2.6 Prospective Payment System (PPS) – Exempt Cancer Hospital Quality Reporting (PCHQR)

PPS–Exempt Cancer Hospital Quality Reporting (PCHQR) was established under Section 3005 the Affordable Care Act to encourage hospitals and clinicians to improve the quality of inpatient care provided to Medicare beneficiaries by ensuring that providers are aware of and reporting on best practices for their respective facilities and type of care. Table B.5 provides a list of PCHQR measures and the categories that they fall under.

Table B.5. List of PCHQR Measures

Measure Category	Measure ID	Measure Description
Oncology Care	PCH-14	Radiation Dose Limits to Normal Tissues
	PCH-15	Plan of Care for Pain – Medical Oncology and Radiation Oncology
	PCH-16	Medical and Radiation - Pain Intensity Quantified
	PCH-17	Adjuvant Hormonal Therapy for High Risk Prostate Cancer Patients
	PCH-18	Avoidance of Overuse Measure - Bone Scan for Staging Low Risk Prostate Cancer Patients
Cancer Treatment	PCH-1	Adjuvant Chemotherapy for Colon Cancer
	PCH-2	Combination Chemotherapy for Breast Cancer
	PCH-3	Hormonal Therapy for Breast Cancer
External Beam Radiotherapy (ERBT)	PCH-25	External Beam Radiotherapy for Bone Metastases
Patient Experience (from HCAHPS survey)	H_CLEAN_STAR_RATING	Cleanliness – star rating
	H_COMP_1_STAR_RATING	Nurse communication - star rating
	H_COMP_2_STAR_RATING	Doctor communication - star rating
	H_COMP_3_STAR_RATING	Staff responsiveness - star rating
	H_COMP_4_STAR_RATING	Pain management - star rating
	H_COMP_5_STAR_RATING	Communication about medicines - star rating
	H_COMP_6_STAR_RATING	Discharge information - star rating
	H_COMP_7_STAR_RATING	Care transition - star rating
	H_HSP_RATING_STAR_RATING	Overall hospital rating - star rating
	H_QUIET_STAR_RATING	Quietness - star rating
	H_RECMND_STAR_RATING	Recommend hospital - star rating
	H_STAR_RATING	Summary star rating

Glossary

Achievement Points are the number of points awarded (from 0–10) for each measure or dimension based on where the hospital's performance period rate falls on the achievement range, defined as the range from the achievement threshold to the average. Achievement points are calculated for each Clinical Process measure and Patient Experience dimension in the HVBP program.

Achievement Threshold is the 50th percentile rate of all hospitals' performance for a measure or dimension during the baseline period. This is the starting point for the achievement range, which is used to determine a hospital's achievement points for each measure or dimension CMS's HVBP program. A hospital whose performance during the performance period is greater than the achievement threshold on a measure or dimension will be awarded achievement points.

Admission from another hospital indicates the patient was admitted to this hospital from another short-term, acute-care hospital. This usually signifies that the patient required the transfer in order to obtain more specialized services than the originating hospital could provide.

Age group in years, calculated on the basis of the age of the beneficiary at the end of the prior year.

Associated principal diagnoses refers to principal diagnoses that appear with the procedure you have chosen; for example, "For what conditions do patients receive total hip replacement?"

Average is the mean of the top decile of all hospitals' performance for a measure or dimension during the baseline period in the HVBP program. This is the ending point for the achievement range, which is used to determine a hospital's achievement points for each measure or dimension. A hospital whose performance during the performance period is greater than the average on a measure or dimension will be awarded the full 10 achievement points.

Baseline Rate (or Baseline Period Rate) is a hospital's performance rate for a measure or dimension during the baseline period in the HVBP program. The rate is based on the numerators and denominators for each measure or dimension in the baseline period. The rate is calculated by dividing each measure or dimension's denominator by its numerator.

Baseline Time Period is the time period used to establish the performance standards (i.e., thresholds and averages) for a given HVBP program year.

Clinical Process of Care Domain score is the sum of a hospital's measure scores (i.e., the higher of improvement or achievement) for the Clinical Process of Care domain in the HVBP program. This score is considered "unweighted" until the domain weighting is applied, then it

becomes the "weighted" domain score. This presents a hospital's score for the condition or procedure and is the sum of the measures for that condition or procedure.

Condition/Procedure Score presents a hospital's score for the condition or procedure and is the sum of the measures for that condition or procedure.

Consistency points are awarded by comparing an individual hospital's HCAHPS Survey dimension rates during the performance period to all hospitals' HCAHPS Survey rate from a baseline period.

Denominator is the number of measure-specific discharges used for quality measure calculations.

Diagnosis indicates a specific condition or disease affecting hospitalized patients.

Dimension Score is the score awarded to a hospital for each Patient Experience of Care dimension in the HVBP program, based on the greater of the Improvement and Achievement points.

Disabled refers to patients with this reason for Medicare entitlement (original or current) listed as either disabled or ESRD/disabled in the RIF MBSF.

Dual eligible includes patients who are covered by both Medicare and Medicaid.

Eligible Clinical Process of Care Measures are the number of measures from the Clinical Process of Care domain where the hospital met the minimum number of cases (10) for at least the minimum number of measures (4).

Emergency department visit rates are the share of the sub-population that is admitted to the ED, presented per 1,000 beneficiaries.

End stage renal disease refers to patients with this reason for Medicare entitlement (original or current) listed as either ESRD or ESRD/disabled in the RIF MBSF.

Floor is the performance of the worst-performing hospital for each Patient Experience of Care dimension in the HVBP program. The floor is used to calculate each hospital's Consistency Score for the Patient Experience of Care domain.

Geographical lines were derived using the five-digit Federal Information Processing Standard (FIPS) code, which uniquely identifies counties and county equivalents in the United States, certain U.S. possessions, and certain freely associated states.

HCAHPS Base Score is one of two components of the Patient Experience of Care domain in the HVBP program, this is the sum of a hospital's scores from the eight (8) Patient Experience of Care dimensions. A hospital can earn a total of 80 points towards their Patient Experience of Care domain.

HCAHPS Consistency Score is one of two components of the Patient Experience of Care domain in the HVBP program, consistency points, which range from 0–20; provide an added incentive for hospitals to achieve at least median performance (i.e., the 50th percentile) on all eight dimensions of the Patient Experience of Care domain. Consistency Points are awarded based on the single lowest of a hospital's eight dimensions compared to the floor.

Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Survey is a standardized survey instrument and data collection methodology that has been in use since 2006 to measure patients' perspectives of hospital care.

Hospitalization rates are the frequency of inpatient hospital discharges for a specific disease in a given year, presented per 1,000 beneficiaries.

Hospital Value-Based Purchasing (HVBP) is a CMS initiative that rewards acute-care hospitals with incentive payments for the quality care provided to Medicare beneficiaries. Established under section 1886(o) of the Social Security Act, the HVBP Program is part of CMS's larger quality strategy to reform how health care is delivered and paid.

Hospital Value-Based Purchasing (HVBP) Exclusion is when the hospital did not report minimum measures and/or cases that apply to the hospital for the performance period for the fiscal year under sections 1886(o)(1)(C)(ii)(III) and 1886(o)(1)(C)(ii)(IV) the Social Security Act.

ICD-9-CM stands for the "International Classification of Diseases, 9th revision, Clinical Modification." ICD-9-CM code is valid until September 30, 2015 in CMS FFS claims. All diagnoses (or conditions) and all procedures that patients receive in the hospital are assigned an ICD-9-CM code. Codes for diagnoses can be up to five digits long, and codes for procedures can be up to four digits long. There are approximately 14,000 diagnosis codes and 4,000 procedure codes. Each hospital stay can have multiple assigned diagnosis and procedure codes.

ICD-10-CM[68] stands for the "International Classification of Diseases, 10th revision, Clinical, Modification." ICD-10-CM replaced the ICD-9-CM coding system and took effect on October 1st, 2015. All diagnoses (or conditions) and all procedures that patients receive in the hospital

[68] ICD-10-CM/PCS Overview, CMS, https://www.cms.gov/Medicare/Coding/ICD10/downloads/ICD-10Overview.pdf

are assigned an ICD-10-CM code. Codes for diagnoses can be up to seven digits long, and codes for procedures can be up to four digits long. There are approximately 68,000 diagnosis codes and 87,000 procedure codes. Each hospital stay can have multiple assigned diagnosis and procedure codes.

Improvement Points is The number of points awarded (from 0–9) for each measure or dimension in the HVBP program based on where the hospital's performance period rate falls on the improvement range, defined as the range from the hospital's performance on that measure or dimension during the baseline period to the comparison. These are calculated for each Clinical Process measure and Patient Experience dimension.

Ineligible Hospital is a hospital that does not meet the statutory requirements for inclusion in the HVBP program. Examples include but are not limited to: Critical Access Hospitals, PPS-exempt cancer hospitals, and children's hospitals.

Measure Score is the score awarded to a hospital for each Clinical Process of Care measure in the HVBP program, based on the greater of the Improvement and Achievement points.

Medicaid includes fee-for-service (FFS) and managed care Medicaid patients.

Medicare includes fee-for-service (FFS) and managed care Medicare patients.

Normalized Clinical Process of Care Domain Score is the result of a calculation that only takes into account the measures from the Clinical Process of Care domain in the HVBP program that a hospital had the minimum number of cases for. So as not to penalize a hospital that does not meet the minimum number of cases for a particular measure, this calculation includes the points for only those measures that a hospital had the minimum number of cases for, divided by the total possible points from those measures with the minimum number of cases.

Numerator is the number of patients that received the specified care on a given quality measure.

Patient Experience of Care Domain Score is the sum of a hospital's dimension scores (i.e., the higher of improvement or achievement) and its consistency score for the Patient Experience of Care domain in the HVBP Program. This score is considered "unweighted" until the domain weighting is applied, when it becomes the "weighted" domain score.

Performance Rate is based on the numerators and denominators for each measure or dimension in the HVBP Program in the performance period. The rate is calculated by dividing each measure or dimension's denominator by its numerator.

Performance Time Period is the time period in the HVBP program used to identify a hospital's performance rate for a given program year.

Prevalence rates are the share of the sub-population that is found to have a specific disease in a given year.

Principal costs are the costs associated with the principal diagnosis.

Principal diagnosis is the condition established after analysis to be chiefly responsible for occasioning the admission of the patient to the hospital for care. The principal diagnosis is always the reason for admission (definition according to the Uniform Bill (UB-92)).

Prevention Quality Indicators are measures that can be used with hospital inpatient discharge data to identify "ambulatory care sensitive conditions." These are conditions for which good outpatient care can potentially prevent the need for hospitalization or for which early intervention can prevent complications or more severe disease.

Risk-adjusted costs are expected total costs adjusted for a beneficiary's health status and demographic information.

Total cost is the sum of all costs associated with all diagnosis codes.

Total Performance Score (**TPS**) is a calculation of the hospital's overall performance score based on a weighted total of the hospital's domain scores in the HVBP program.

Unweighted Domain Score is the raw sum of a hospital's measure scores for all domains in the HVBP Program.

Urban/rural indicators – The ability to distinguish between urban and rural counties has been incorporated into the MMD Tool, classifying each county using data from the National Bureau of Economic Research.[69] According to this classification, the U.S. Office of Management and Budget designates counties as *metropolitan* (a core urban area of 50,000 or more population), *micropolitan* (an urban core of at least 10,000 but less than 50,000 population), or neither.[70] The MMD Tool presents the *metropolitan* and *micropolitan* areas, known as core based statistical areas (CBSAs) as "urban," and all other areas (i.e., counties that are not part of a CBSA) as "rural."

[69] National Bureau of Economic Research (NBER). SSA to FIPS CBSA and MSA County Crosswalk. Cambridge, MA: NBER.Accessed January 2015.

http://www.nber.org/data/cbsa-msa-fips-ssa-county-crosswalk.html

[70] U.S. Census Bureau. Geographic Terms and Concepts. Washington, DC: Census Bureau. Accessed January 2015. https://www.census.gov/geo/reference/gtc/gtc_cbsa.html

Weighting is the percentage assigned to each HVBP domain, with the sum of the domain weights totaling 100 percent.

Weighted Domain Score is the result of multiplying a domain's unweighted domain score by the domain weighting. This is used in the calculation of the TPS in the HVBP Program.