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

The Mapping Medicare Disparities Tool

Technical Documentation

Prepared by

NORC at the University of Chicago
55 East Monroe Street, 30th Floor
Chicago, IL 6060

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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 following a preset schedule. Table 1 summarizes the list of changes or revisions since the initial release of the Tool.

Table 1. Revision History for the Mapping Medicare Disparities Tool

Topic	Date	Description
New Data	10/25/23	• Added 2022 preliminary Medicare FFS claims to the Population View. • Added 2020 state & county-level Social Determinants of Health (SDOH) data to the Population View.
New Feature	10/25/23	• Added a census-tract-level Social Determinants of Health (SDOH) view to the MMD tool. This view includes 7 new SDOH measures using 2020 data. • Added Sickle Cell Disease as a condition for the Medicare FFS population in the Population View, starting with the 2022 preliminary Medicare FFS claims.
New Feature	7/26/23	• Added 2018 Medicare Advantage (MA) data to the Population View. • Added the Behavioral Health Domain to the Medicare FFS Population View. These conditions were previously found under the Chronic and potentially disabling conditions domain. • Added the 65+ age category for 2021 Medicare FFS and 2018 MA to the Population View
New Data	7/26/23	• Added the final 2021 Medicare FFS claims to the Population View. • Added additional Market Saturation measure (i.e., Users per Provider) in the Population View. • Added Alcohol Use Disorder (AUD) and Drug Use Disorder (DUD) conditions for the Medicare FFS population in the Population View.
New Data	4/19/23	• Refreshed the socio-economic variables in the National/State/County Profile View (under the Population View) with the 2021 American Community Survey (ACS) data. • In the Population View, added the number of providers and number of users per provider for six types of medical services (cardiac rehabilitation program, dialysis, ophthalmology, preventive health services, psychotherapy, and telemedicine) from the CMS Market Saturation and Utilization data. • Refreshed the Hospital View with the January 2023 release of the Hospital Compare data. Added 11 new measures and removed 3 measures with no data from the Hospital Compare data.
New Data	10/12/22	• Added the final 2020 Medicare FFS claims and the preliminary 2021 Medicare FFS claims to the Population View. • For 2020 and 2021 Medicare FFS claims, the new Race and Ethnicity groups based on the Medicare Bayesian Improved Surname and Geocoding (MBISG) methodology are used in the Population View. • Effective for 2021 analysis and forward, the updated CCW 30 Chronic Condition algorithms and indicators are used.

Topic	Date	Description
New Data	8/17/22	• Refreshed the socio-economic variables in the National/State/County Profile View (under the Population View) with the 2020 American Community Survey (ACS) data. • Refreshed the Hospital View with the January 2022 release of the Hospital Compare data.
New Data	10/11/21	• Added the final 2019 Medicare claims (100% complete) and the preliminary 2020 Medicare claims (99% complete) to the Population View. Will update with the final 2020 Medicare claims in the next data update. • Smoothed actual rates and smoothed age standardized rates are now available for the 2019 and 2020 data in the Population View. • Inpatient measures are temporarily disabled for the preliminary 2020 data in the Population View, due to the data not being available yet. • Added one new condition for Prevalence and Hospitalization measures to the Population View for 2020: COVID-19. • Refreshed the Hospital View with the January 2021 release of the Hospital Compare data. • Added one new measure to the Hospital View: MedCoPsy (Medication Continuation Following Inpatient Psychiatric Discharge). • Removed four retired measures from the Hospital View: PCH-14 (Radiation Dose Limits to Normal Tissues), PCH-16 (Medical and Radiation - Pain Intensity Quantified), PCH-17 (Adjuvant Hormonal Therapy for High Risk Prostate Cancer Patients), and PCH-18 (Avoidance of Overuse Measure - Bone Scan for Staging Low Risk Prostate Cancer Patients).
New Data	2/26/2021	• Added the preliminary 2019 Medicare claims (99% complete) to the Population View. Will update with the final 2019 Medicare claims in Fall 2021. • Smoothed actual rates and smoothed age standardized rates are temporarily disabled for the preliminary 2019 data in the Population View. The smoothed rates may be available for the final 2019 data release in Fall 2021. • Consistent with the AHRQ methodology, removed two retired Prevention Quality Indicator (PQI) measures, PQI 2 (Perforated Appendix) and PQI 10 (Dehydration), from the Population View, starting in 2019 and will not produce moving forward. Data for these measures are still available for previous years (2012 – 2018). Two composite PQI measures (PQI 90 and PQI 91) are affected by the retirement of PQI 10, since PQI 10 was one of the member measures of the two composites. • Refreshed the socio-economic variables in the National/State/County Profile View (under the Population View) with the 2019 American Community Survey (ACS) data.
New Feature	6/29/2020	• Created a new menu option to allow for comparison of measure rates by the original reason for Medicare entitlement.
New Feature	6/29/2020	• Added a downloadable Population Report under the Population View, which shows the prevalence rate for five chronic conditions (Hypertension, Diabetes, Chronic Kidney Disease, COPD, and Congestive Heart Failure), stratified by beneficiary race and ethnicity for each state and county included in the MMD Tool.

Topic	Date	Description
New Data	6/29/2020	• Added the 2018 Medicare claims to the Population View. • Refreshed the Hospital View with the January 2020 release of the Hospital Compare data. • Added five new measures to the Hospital View: Clostridium Difficile (C.Diff): SIR; MRSA Bacteremia: SIR; SSI - Colon Surgery; SSI - Abdominal Hysterectomy: SIR; and Influenza Vaccination Coverage among Healthcare Personnel: Adherence Rate. • Removed five retired measures in from the Hospital View: Alcohol Use Screening, Tobacco Use Screening, Adjuvant Chemotherapy for Colon Cancer, Combination Chemotherapy for Breast Cancer, and Hormonal Therapy for Breast Cancer.
New Data	2/24/2020	• Refreshed the socio-economic variables in the National/State/County Profile View (under the Population View) with the 2018 American Community Survey (ACS) data.
New Data	6/17/2019	• Added five new inpatient measures to the Population View for 2012-2017: average inpatient days per admission, number of PSI admissions per 100,000 beneficiaries, average Medicare reimbursement per admission, admission rate by admission type, and admission rate by discharge destination. • Updated the Hospital View data (refreshed on 3/14/2019) and added six new measures: appropriate care for severe sepsis and septic shock, hospital return days for pneumonia patients, hospital return days for heart attack patients, hospital return days for heart failure patients, hip/knee complications, and Medicare spending per beneficiary. • Removed two retired measures from the Hospital View: stroke 30-day readmission rate and pain management. • Added the following data items under Population View State/County Profile View: race and ethnicity distribution, insurance coverage by insurance type and age group. • Removed the following data items under the Population View State/County Profile View: housing vacancy, and employment rate by household size.
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	9/6/2018	• 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

Topic	Date	Description
New Feature	9/6/2018	• 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	3/23/2018	• 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	3/23/2018	• Added readmission and mortality rates for CY 2015.
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. 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 Introduction

The Mapping Medicare Disparities (MMD) Tool was first launched in 2016. It is an interactive visualization tool centered around a state/county-level map of the United States which allows users to easily identify the geographic disparities in utilization and outcome measures in the Medicare population. Originally focused on chronic condition prevalence, the tool currently contains many additional measures across multiple domains, such as costs, service utilization, quality of care, and health outcomes. The claims data processing is conducted using SAS, with post-processing data analytics conducted in STATA and R. The front-end visualization is programmed in JavaScript, using libraries including d3.js and its derivatives.[1] The MMD Tool includes three views - the Population View, the Hospital View, and the Social Determinants of Health View.

2.2 MMD Tool – Population View

The 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, original reason for entitlement, 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.

In addition to health outcomes, utilization, and spending metrics, the MMD Tool also presents the number of providers, along with the number of users per provider, for selected type of medical services (i.e., cardiac rehabilitation program, dialysis, ophthalmology, preventive health services, psychotherapy, and telemedicine) at the state and county level to identify and visualize potential disparities in service provider supply by geographic locations. For year 2020, the Population View also includes the 7 selected SDOH measures presented at the county level and 6 measures also presented at the state level.

[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.

2.3 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).

2.4 Social Determinants of Health (SDOH) View

The SDOH view is designed to provide users with a list of non-medical factors that influence health utilization and outcomes. The view presents publicly available county- and census tract-level data that applies to all individuals or households (not just the Medicare population) in a given geography for 7 SDOH measures across four domains, including Educational Attainment, Healthcare Access and Quality, Environment, and Social and Community Context. The data presented is from year 2020. Additional measures, domains, and years of data may be added in future deployments.

3. Data and Analysis

3.1 MMD Tool – Population View

Two populations are available within the Population View, Medicare Fee-for-Service (FFS) and Medicare Advantage (MA). The data used in the Fee-for-Service 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) – and Geographic Variation Database (GVDB) Beneficiary Summary File 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
- 100% Geographic Variation Database Inpatient Claim File

The methodologies used to calculate hospitalization rates, preventable hospitalizations, readmission rates, mortality rates, and the inpatient admission measures require only inpatient claims data (in addition to the MBSF or the GVDB Beneficiary Summary File 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 aged 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.

The number of providers, along with the number of users per provider and the number of FFS beneficiaries, are extracted from the CMS Market Saturation & Utilization State-County dataset[2] released as of January 2023. This dataset provides information on the density of providers of a particular service in a defined geographic area relative to the number of FFS beneficiaries in that area. For the number of provider measure, a provider is defined as serving a county if the provider has paid claims for 11 or more beneficiaries located in that county throughout the calendar year. Similarly, a provider is defined as serving a state if the provider serves at least one county in that state. Medicare claims are used to define the geographic areas served by a provider instead of the provider's practice address. For the number of users per provider and number of FFS beneficiary measures, a FFS beneficiary is any Part A and/or Part B enrollee with FFS coverage for at least one month of the calendar year reference period. For inclusion in the dataset, an enrollee must not have a death date for that month and must have a valid zip code so that they can be assigned to a county.[3]

The MMD tool currently presents the number of providers for the following services:

- Cardiac Rehabilitation Program

[2] CMS Market Saturation and Utilization Summary: Market Saturation & Utilization State-County - Centers for Medicare & Medicaid Services Data (cms.gov)
[3] For more detailed methodology, visit Market Saturation & Utilization State-County Methodology - Centers for Medicare & Medicaid Services Data (cms.gov)

- Dialysis
- Ophthalmology
- Preventive Health Services
- Psychotherapy
- Telemedicine

In the tool, these services are displayed in the Condition/Service dropdown menu once Measure is set to Number of Providers. Once a service is selected, the Tool presents the number of providers, along with the number of users per provider and number of FFS beneficiaries, in a county or state. These measures are available for 2015 through 2022 for all services, except for Telemedicine, which is available for 2017 through 2022.

The data used in the analysis for the Medicare Advantage population comes from the Centers for Medicare & Medicaid Services (CMS) inpatient encounter data for Medicare beneficiaries enrolled in the Medicare Advantage (MA) program, which are available from CMS through the Chronic Conditions Warehouse (CCW; www.ccwdata.org/web/guest/home). These Medicare encounter files were leveraged for the MA analysis, along with CMS's Master Beneficiary Summary File (MBSF) and the Office of Enterprise and Data Analytics' (OEDA) Medicare Advantage Encounter File Provisional Analytical Data (PAD).

The Medicare Advantage analysis contains three inpatient measures among beneficiaries receiving inpatient short-term acute care in 2018: Hospitalizations, Admission Rate by Discharge Destination, and Average Inpatient Days per Admission. Results of the MA analysis are presented at the state level only and allows for selection of one beneficiary characteristic at a time (i.e. sex, race and ethnicity, age group, original reason for entitlement, or dual eligibility) to alleviate potential data quality issue at a more granular level. Additionally, results from MA analysis are presented with all beneficiaries included, instead of stratifying by individual chronic condition since chronic condition indicators have not been created for the MA population.

The MA analysis includes 100 percent of Medicare beneficiaries continuously enrolled in Medicare Advantage program for the selected year (2018). Additionally, beneficiaries who died during the year but otherwise were continuously enrolled up until the date of death, as well as beneficiaries who started enrollment in the middle of a year but were continuously enrolled from that date to the end of the year, are included in the analysis population. We exclude Medicare beneficiaries with any Medicare Fee-for-Service enrollment during the year.

The Population View also presents the 7 SDOH measures at the county level under the Medicare FFS population in year 2020, with six of those measures also available at the state level. See section 4.3 for details about the SDOH measures and the associated data sources.

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.[4] See Appendix B for more details on the data and population used for each measure in the MMD Hospital View.[5]

3.3 MMD Tool – SDOH View

The data used in the SDOH view analysis is sourced from various data sources (e.g., United States Census Bureau's American Community Survey, and CDC PLACES). See section 4.3 for more details on the data and population used for each measure in the MMD SDOH View.

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", "behavioral health conditions", and "COVID-19". Following the CMS's Medicare COVID-19 data snapshot methodology (available at Medicare COVID Methodology (cms.gov) we added the COVID-19 prevalence rate starting in 2021, which is defined as the proportion of beneficiaries with a diagnosis of COVID-19 on a claim for any healthcare setting (e.g., physician's office, inpatient hospital, laboratory).

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-

[4] Available at: https://www.medicare.gov/hospitalcompare/search.html
[5] Data may not be available for some hospitals due to a limited population of eligible cases.

level.[6] 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.[7] 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 Use Disorder measure), 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, original reason for entitlement, 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://www2.ccwdata.org/documents/10280/19140001/oth-cond-algo-oud.pdf. See Appendix A for additional details, including the CCW methodology.

In March 2022, CCW released an updated version of 30 primary Chronic Condition indicators to replace the previous version of 27 Chronic Condition indicators. CCW's assessment on this algorithm update can be accessed at: https://www2.ccwdata.org/documents/10280/19002256/ccw-condition-categories-impact-of-transition-from-27-to-30.pdf?t=1650547850837. As shown in CCW's assessment, some conditions may experience significant changes prevalence rates due to CCW's algorithm update. The new Chronic Condition indicators are applied for preliminary 2021 FFS claims data update and forward.

It is noted that several condition names were changed between these two versions of algorithms. To be consistent with previous years on the Tool, we kept using the existing condition names on the MMD Tool. The only special handling was to recreate the indicator of Alzheimer's Disease and Related Disorders or Senile Dementia, as specified in the previous version of the Chronic Condition algorithm, by combining the two new indicators of Alzheimer's Disease and Non-Alzheimer's Dementia. The two Chronic Condition indicator algorithms can be accessed at: Chronic Conditions - Chronic Conditions Data Warehouse (ccwdata.org).

[6] The CMS HCC model estimates weights (or adjusters) for over 100 diagnostic categories and demographic characteristics (age, gender, etc.) of beneficiaries in regression model with total costs as the dependent variable. These weights can then be used to calculate a risk score for each beneficiary.
[7] 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

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	AHRQ Patient Safety Indicators (PSIs) [8]
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	Agency for Healthcare Research and Quality (AHRQ) methodology

Measure	Prevalence Rates and Costs	Hospitalization Rates	AHRQ Prevention Quality Indicators (PQIs)	Readmission Rates	Mortality Rates	Emergency Department Visit Rates	AHRQ Patient Safety Indicators (PSIs) [8]
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	• 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)	• Diabetes Short-term Complications (PQI 01) • Perforated Appendix (PQI 02; retired in 2019) • Diabetes Long-term Complications (PQI 03) • COPD or Asthma in Older Adults (PQI 05) • Hypertension (PQI 07) • Heart Failure (PQI 08) • Dehydration (PQI 10; retired in 2019) • Bacterial Pneumonia (PQI 11) • Urinary Tract Infection (PQI 12) • Uncontrolled Diabetes (PQI 14) • Lower-Extremity Amputation among Patients with Diabetes (PQI 16)	• 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 • Obesity • Osteoporosis • Prostate Cancer	• Death in Low Mortality DRGs (PSI 02) • Pressure Ulcer (PSI 03) • Death among Surgical Inpatients (PSI 04) • Iatrogenic Pneumothorax (PSI 06) • Central Venous Catheter-Related Bloodstream Infections (PSI 07) • Postoperative Hip Fracture (PSI 08) • Postoperative Hemorrhage or Hematoma (PSI 09) • Postoperative Physiologic and Metabolic Derangement Rate Numerator (PSI 10) • Postoperative Respiratory Failure (PSI 11) • Postoperative Pulmonary

Measure	Prevalence Rates and Costs	Hospitalization Rates	AHRQ Prevention Quality Indicators (PQIs)	Readmission Rates	Mortality Rates	Emergency Department Visit Rates	AHRQ Patient Safety Indicators (PSIs) [8]
	• Prostate Cancer • Rheumatoid Arthritis / Osteoarthritis • Schizophrenia/Other Psychotic Disorders • Stroke / Transient Ischemic Attack • 0, 1, 2, or 3+ Conditions [4]End Stage Renal Disease (ESRD) • Disability	• Prostate Cancer (CCW) • 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 Overall Composite (PQI 90) • Prevention Quality Acute Composite (PQI 91) • Prevention Quality Chronic Composite (PQI 92)			• 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	Embolism or DVT (PSI 12) • Postoperative Sepsis (PSI 13) • Postoperative Wound Dehiscence (PSI 14) • Accidental Puncture or Laceration (PSI 15)
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	100% GVDB Inpatient 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] 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.

[6] 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.

[7] Four inpatient measures do not require a pre-developed and validated methodology due to their straightforward definition. These measures are average inpatient days per admission, average Medicare reimbursement per admission, admission rate by admission type, and admission rate by discharge destination. Definition of these measures can be found later in this section.

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) **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 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 Peripheral Vascular Disease (PVD) Pressure and Chronic Ulcers Sensory - Blindness and Visual Impairment Sensory - Deafness and Hearing Impairment Sickle Cell Disease [6] **Other Developmental Delays**

Measure	Prevalence Rates, Costs, Hospitalization Rates, and Emergency Department Visit Rates [1]
Behavioral Health Condition	**Anxiety Disorders Bipolar Disorder Depressive Disorders** Post-Traumatic Stress Disorder (PTSD) Personality Disorders Schizophrenia/Other Psychotic Disorders [3] Tobacco Use Alcohol Use Disorder (AUD) Drug Use Disorder (DUD) 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]
Covid-19	**Covid-19** [5]

[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] Sickle Cell Disease data is presented per 100,000 beneficiaries and can only be viewed at the state-level with one demographic stratification at a time due to its low prevalence.

[4] "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."

[5] 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://www2.ccwdata.org/documents/10280/19140001/oth- cond-algo-oud.pdf.

[6] The Covid-19 domain and condition are only available for Prevalence and Hospitalization Rates.

4.1.2 Hospitalization Rates

The hospitalization rate is the frequency of inpatient hospital discharges in a given year per 1,000 beneficiaries. The Fee-for-Service population 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, original reason for entitlement, 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.[8] 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. Following the CMS's Medicare COVID-19 data snapshot methodology (available at Medicare COVID Methodology (cms.gov), we added the COVID-19 hospitalization rate starting in 2020.

The MMD Tool also provides the overall hospitalization rate (all beneficiaries combined) for MA beneficiaries who received short-term acute care in a year. Results are presented at the state level allowing for selection of one beneficiary characteristic at a time (i.e. sex, race and ethnicity, age group, original reason for entitlement, or dual eligibility).

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.[9] 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, original reason for entitlement, and dual eligibility).[10] Two PQI measures - PQI 2 and 10 - were retired in 2019.[11] See Appendix A.2.3 for more details, including the AHRQ PQI methodology.

[8] The Interactive Atlas of Heart Disease and Stroke is available at: https://nccd.cdc.gov/DHDSPAtlas/
[9] 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
[10] AHRQ. Prevention Quality Indicators Technical Specifications. Version 2021 (ICD-10) Rockville, MD: AHRQ. July 2021. AHRQ QI: PQI Technical Specifications Updates
[11] AHRQ. Prevention Quality Indicators Technical Specifications. Version 2021 (ICD-10) Rockville, MD: AHRQ. July 2021. AHRQ QI: PQI Technical Specifications Updates

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).[12] 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, 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, original reason for entitlement, 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, race and ethnicity, and original reason for entitlement).[13] 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).[14] 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, original reason for entitlement, 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, original reason for entitlement, and race and ethnicity). [15] See Appendix A.2.5

[12] QualityNet. Measure Methodology Reports. Baltimore, MD: Centers for Medicare & Medicaid Services. Accessed January 2015.
[13] Because the methodology originally calculates hospital-level measures, these estimates are summarized by the county and state of the hospital's location.
[14] 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
[15] Because the methodology originally calculates hospital-level measures, these estimates are summarized by the county and state of the hospital's location.

for more details, including the CMS mortality rate methodology. Emergency Department Visit Rates

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 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, original reason for entitlement, and dual eligibility). See Appendix A.2.6 for more details on the methodology based on guidance from the Research Data Assistance Center (ResDAC).[16]

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.[17] 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, original reason for entitlement, 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, G0468	Services limited to beneficiaries no longer in the first 12 months of Medicare enrollment.
Bone Mass Measurement	G0130, 77078, 77080, 77081, 76977, 77085	
Cardiovascular Disease Screening	80061, 82465, 83718, 84478	
Colorectal Cancer Screening	G0104, G0105, G0106, G0120, G0121, 82270, 81528, G0328, 00812, G0327	Services limited to beneficiaries aged 50 or older.

[16] Research Data Assistance Center (ResDAC). Identifying Dual Eligible Medicare Beneficiaries in the Medicare Beneficiary Enrollment Files. Minneapolis, MN: ResDAC. October 25, 2018. https://resdac.org/articles/identifying-dual-eligible-medicare- beneficiaries-medicare-beneficiary-enrollment-files

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

Preventive Service	CPT/HCPCS Codes	Additional Criteria
Counseling to Prevent Tobacco Use	99406, 99407	
Depression Screening	G0444	
Diabetes Screening	82947, 82950, 82951	
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	90662, 90672, 90674, 90682, 90685, 90686, 90687, 90688, 90694, Q2039, G0008, 90756	
Initial Preventive Physical Examination (IPPE)	G0402, G0403, G0404, G0405, G0468	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, 71271	
Medical Nutrition Therapy (MNT) Services	97802, 97803, 97804, G0270, G0271	
Pneumococcal Vaccine	90670, 90732, G0009, 90671, 90677	
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	77063, 77067	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.
Ultrasound Screening for Abdominal Aortic Aneurysm (AAA)	76706	

Note: The HCPCS/CPT codes in this table reflect the most recent updates. 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

4.1.8 Admission Rates by Admission Type

The admission rate by admission type is the frequency of a specific type of inpatient admission per 1,000 inpatient admissions in a year. The Population View of the MMD Tool provides the admission rates for four types of inpatient admissions - emergency, urgent, elective, and other type - by *beneficiary characteristics* (i.e., every combination of state/territory and county of residence, sex, age group, race and ethnicity, original reason for entitlement, and dual eligibility). The type of inpatient admissions is recorded on the Medicare claims. See Appendix 2. 2.8 for more details on the methodology.

4.1.9 Admission Rate by Discharge Destination

The admission rate by discharge destination is the frequency of admissions with a specific discharge destination per 1,000 inpatient admissions in a year. Both the Fee-for-Service and Medicare Advantage populations of the MMD Tool provides the admission rates for four different discharge destinations – home/self-care, skilled nursing facilities, home health agencies, and other destination. The FFS population provides data by multiple *beneficiary characteristics* (i.e., every combination of state/territory and county of residence, sex, age group, race and ethnicity, original reason for entitlement, and dual eligibility), while the MA population provides state level data by one beneficiary characteristic at a time (i.e. sex, race and ethnicity, age group, original reason for entitlement, or dual eligibility). The discharge destination is recorded on the Medicare claims and encounters. See Appendix 2.2.9 for more details on the methodology.

4.1.10 Preventable Hospital Complications - Agency for Healthcare Research and Quality (AHRQ) Patient Safety Indicators (PSIs)

Measures of Patient Safety Indicators were developed by AHRQ to measure hospital quality of care for adult patients, which focuses on potentially avoidable in-hospital complications and adverse events following surgeries, procedures, and childbirth.[18] The Population View of the MMD Tool includes 13 PSI indicators (See Table 2) by beneficiary characteristics (i.e., every combination of state/territory and county of residence, sex, age group, race and ethnicity, original reason for entitlement, and dual eligibility). See Appendix A.2.10 for more details, including the AHRQ's PSI methodology.

4.1.11 Average Inpatient Days and Average Medicare Reimbursement

The average inpatient days is the average Medicare-covered days of care provided per admission. The average Medicare reimbursement is the average amount that Medicare paid per admission.

The MMD Tool provides average inpatient days and average Medicare reimbursement for the Medicare FFS population by *beneficiary characteristics* (i.e., every combination of state/territory and county of residence, sex, age group, race and ethnicity, original reason for entitlement, and dual eligibility). The MMD tool also presents the average inpatient days for the MA population

[18] Patient Safety Indicators Overview. PSI Resources. Agency for Healthcare Research and Quality. Accessed May 2019. https://www.qualityindicators.ahrq.gov/Modules/psi_resources.aspx

at the state level allowing for selection of one beneficiary characteristic at a time (i.e. sex, race and ethnicity, age group, original reason for entitlement, or dual eligibility).

4.1.12 Number of Providers

The number of providers, along with the accompanying information on the number of users per provider and number of FFS beneficiaries, are extracted from the CMS Market Saturation & Utilization State-County dataset. The number of providers is the number of providers of a specific service serving a county or state. Medicare claims are used to define the geographic areas served by a provider instead of the provider's practice address. A provider is defined as serving a county for a particular service if the provider has paid claims for 11 or more beneficiaries located in that county throughout the calendar year. Similarly, a provider is defined as serving a state if they served at least one county in that state. For detailed information on this measure, please visit Market Saturation & Utilization State-County Methodology - Centers for Medicare & Medicaid Services Data (cms.gov)[19].

4.1.13 Social Determinants of Health

The Social Determinants of Health measures display publicly available state and county-level data of individuals and households about Educational Attainment, Healthcare Access and Quality, Environment, and Social and Community Context. Social Vulnerability Index (SVI) data is presented at the county level only as the SVI is a relative index at the county level. See section 4.3 for more details on these measures and the methodology.

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[20]	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

[19] Market Saturation & Utilization State-County - Centers for Medicare & Medicaid Services Data (cms.gov)
[20] All readmission measures are based on a 30-day risk-standardized rate.

Domain	Sub-domain	Measures
	Unplanned Hospital Visits	• Rate of Unplanned Hospital Visits after Colonoscopy (per 1,000 colonoscopies) • Hospital Return Days for Heart Attack Patients • Hospital Return Days for Heart Failure Patients • Hospital Return Days for Pneumonia Patients
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
	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
	Hip/Knee Complications	Hip/Knee Complications
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 • Medicare Spending per Beneficiary

Domain	Sub-domain	Measures
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 • 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
Inpatient Psychiatric Facility Quality Reporting (IPFQR)	None	• Hours of physical restraint use • Hours of seclusion • Patients discharged on multiple antipsychotic medications with appropriate justification • Influenza Immunization • Alcohol Use Brief Intervention Provided or Offered • Alcohol Use Brief Intervention • 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 • Medication Continuation Following Inpatient Psychiatric Discharge
Prospective Payment System (PPS) – Exempt Cancer Hospital Quality Reporting (PCHQR)	Oncology Care	• Plan of Care for Pain – Medical Oncology and Radiation Oncology
	Exempt Cancer Hospital Quality Reporting	• Clostridium Difficile (C Diff): SIR • MRSA Bacteremia: SIR • SSI - Colon Surgery: SIR • SSI - Abdominal Hysterectomy: SIR • Central Line-Associated Bloodstream Infection (CLABSI): SIR • Catheter-Associated Urinary Tract Infections (CAUTI): SIR • Influenza Vaccination Coverage among Healthcare Personnel: Adherence Rate • COVID-19 Primary Series Vaccination Coverage among Healthcare Personnel: Adherence Rate

Domain	Sub-domain	Measures
Effective Care	Effective Care	• Appropriate Care for Severe Sepsis and Septic Shock • COVID-19 Primary Series Vaccination Coverage among Healthcare Personnel: Adherence Rate • Admit Decision Time to ED Departure Time for Admitted Patients - non psychiatric/mental health disorders • Discharged on Antithrombotic Therapy • Antithrombotic Therapy by End of Hospital Day 2 • Anticoagulation Therapy for Atrial Fibrillation/Flutter • Discharged on Statin Medication • Venous Thromboembolism Prophylaxis • Intensive Care Unit Venous Thromboembolism Prophylaxis

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.[21]

Table 6 provides the national unadjusted readmission rates per condition.

Table 6. National Unadjusted Average Readmission (or Unplanned Hospital Visit) Rate per Condition [22]

Conditions	Rate
Acute Myocardial Infarction (AMI)	15.7%
Coronary Artery Bypass Graft (CABG)	12.8%
Chronic Obstructive Pulmonary Disease (COPD)	19.5%
Heart Failure (HF)	21.6%
Hip/Knee Replacement	4.0%
Pneumonia (PN)	16.6%
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, original reason for entitlement, and age group) and how much of the

[21] 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, 2018 to June 30, 2021.
[22] The National Unadjusted Readmission Rates per Condition are found in the Unplanned Hospital Visits dataset in Hospital Compare. Data is collected from July 1, 2018 to June 30, 2021.

variation in hospital readmission rates can be attributed to the hospital where the condition was diagnosed.

Rate of unplanned hospital visits after an outpatient colonoscopy reports 7-day risk standardized hospital visit rate after outpatient colonoscopy. The hospital return days measures add up the number of days patients spent back in the hospital (in the emergency department, under observation, or in an inpatient unit) within 30 days after they were first treated and released.

These measures compare each hospital's return days to results from an average hospital with similar patients to determine if this hospital has more, similar, or fewer days than average.

4.2.2 Patient Safety

There are four subdomains within the safety domain: (1) Patient Safety Indicators (PSI); (2) Healthcare Associated Infections (HAIs); (3) Mortality, and (4) Hip/Knee Complications.

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 combination of two or more individual scores in a measure that results in a single score.[23] The measures are based on the AHRQ's PSIs. See Appendix B.2.2 for a list of PSIs.

Rate of Complications for Hip/Knee Replacement Patients

This measure reports hospital-level risk-standardized complication rate (RSCR) following elective primary total hip arthroplasty (THA) and total knee arthroplasty (TKA).

Healthcare-Associated Infections (HAI)

HAI are infections patients can get while receiving medical treatment in a healthcare facility.[24] These infections are a major, yet often preventable, threat to patient safety.[25] 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;

[23] 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 February 23, 2023. http://www.qualityforum.org/Publications/2009/08/Composite_Measure_Evaluation_Framework_and_National_Voluntary_Cons ensus_Standards_for_Mortality_and_Safety%E2%80%94Composite_Measures.aspx

[24] Healthcare-Associated Infections (HAIs) | HAI | CDC. Centers for Disease Control and Prevention (CDC).

[25] Ibid.

- 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

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.

In addition, there is a Medicare Spending per Beneficiary (MSPB) measure. The Medicare Spending Per Beneficiary (MSPB) Measure assesses Medicare Part A and Part B payments for services provided to a Medicare beneficiary during a spending-per-beneficiary episode that spans from three days prior to an inpatient hospital admission through 30 days after discharge. The payments included in this measure are price-standardized and risk-adjusted. Price standardization removes sources of variation that are due to geographic payment differences such as wage index and geographic practice cost differences, as well as indirect medical education (IME) or disproportionate share hospital (DSH) payments. Risk adjustment accounts for variation due to patient health status. This measure is a ratio. A ratio over 1 indicates a higher spending relative to the national median spending; and a ratio under 1 indicates a lower spending relative to the national median spending.

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[26]; and
- Safety

Medicare makes the incentive payments to hospitals based on either:

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

Prior to the 2023 update, the MMD tool included data for each of these domains as well as the aggregated Total Performance Score (TPS). Due to lack of updated data, starting in 2023 the tool only includes scores in the Clinical Care and Efficiency domains. See Appendix B.2.4 for descriptions of the calculation methodology of the measures and HVBP terms.

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.[27] 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).[28] PCHQR was established

[26] 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://qualitynet.cms.gov/inpatient/hvbp/measures

[27] https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/IPFQR.html.
Accessed on February 23, 2023.

[28] https://www.cms.gov/Medicare/Quality-Initiatives-Patient-Assessment-Instruments/HospitalQualityInits/PCHQR.html.
Accessed on February 23, 2023.

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.[29] See Appendix B.2.6 for a list of PCHQR measures.

4.2.8 Effective Care

The effective care domain includes quality measures that aim to assess the timeliness and effectiveness of care provided to patients.[30] See Appendix B.2.7 for a list of effective care measures.

4.3 Social Determinants of Health (SDOH) View

Unlike the Population and Hospital views, the Social Determinants of Health (SDOH) view does not report claims data, nor does it report data specific to the Medicare population. Instead, it displays publicly available county- and census tract-level data that applies to all individuals or households in a given geography. All data presented is from 2020. Without selecting a state, the tool displays county-level data for each county in the United States. Once a state is selected, that state instead displays the selected measure at the census-tract level. The seven measures contained in the SDOH view and their data sources are displayed in Table 7.

Table 7. SDOH Measures and Data Source

Domain	Measure	Source
Educational attainment	Percent with only high school diploma or equivalent	American Community Survey (ACS)
Health care access and quality	Percent current on preventive services (65+)	CDC PLACES
Environment	Particulate matter (PM2.5)	AHRQ SDOH Database
Social and community context	Social Vulnerability Index (SVI)	CDC SVI
Social and community context	Median household income	AHRQ SDOH Database
Social and community context	Percent owner-occupied housing units	AHRQ SDOH Database
Social and community context	Percent housing units with no vehicle	AHRQ SDOH Database

4.3.1 Educational Attainment

The educational attainment domain contains the percent with only high school diploma or equivalent. This measure is defined as the percentage of the 25 and older population in a given geography that has earned a high school diploma or equivalent but have not completed any

[29] Ibid.
[30] Hospitals - Timely & effective care | Provider Data Catalog (cms.gov). Accessed on March 6, 2023.

college coursework. These data are from the United States Census Bureau's American Community Survey (ACS).[31]

4.3.2 Health Care Access and Quality

The health care access and quality domain contains one measure: the percent current on preventive services in the 65 and older population. This measure is calculated as the average of the 65 and older male and 65 and older female percentages from the CDC PLACES database.[32] An individual is up to date on preventive services if they have received all of the following:

- An influenza vaccination in the past year
- A pneumococcal vaccination (PPV) ever
- Either a fecal occult blood test (FOBT/FIT) within the previous year, a FIT-DNA test within the previous 3 years, a sigmoidoscopy within the previous 5 years, a sigmoidoscopy within the previous 10 years with a FOBT in the previous year, a colonoscopy within the previous 10 years, or a CT colonography (virtual colonoscopy) within the previous 5 years
- A mammogram in the past 2 years (women only).

4.3.3 Environment

The environment domain contains the particular matter (PM2.5) measure of air quality. PM2.5 refers to the concentration of particulate pollutants with a width that is 2.5 microns or smaller in the air. The data series is from the Agency for Healthcare Research and Quality (AHRQ) SDOH database, which aggregates data from the US Environmental Protection Agency (EPA).[33]

4.3.4 Social and Community Context

The social and community context domain contains four measures: the Social Vulnerability Index (SVI), the median household income, the percent housing units that are occupied by their owner, and the percent of housing units with no vehicle. The SVI is calculated by the CDC by aggregating sixteen data series across four categories: socioeconomic status, household characteristics, racial & ethnic minority status, and housing type & transportation.[34]

The non-SVI measures in the social and community context domain include data from AHRQ's SDOH database,[35] which aggregates household-level data from the United States Census Bureau's American Community Survey (ACS).

[31] American Community Survey (ACS) (census.gov)
[32] Prevention Measure Definitions | PLACES: Local Data for Better Health | CDC
[33] Social Determinants of Health Database | Agency for Healthcare Research and Quality (ahrq.gov)
[34] CDC/ATSDR Social Vulnerability Index (SVI)
[35] Social Determinants of Health Database | Agency for Healthcare Research and Quality (ahrq.gov)

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, original reason for entitlement, 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.

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).[36] 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, original reason for entitlement, 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.

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.

[36] 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.

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, 2017, 2018, 2019, 2020, 2021, or 2022 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 measures (prevalence rates, risk-adjusted total costs, total costs, principal costs, PQIs, hospitalizations, readmission rates, mortality rates, ED visit rates, preventive services, and inpatient measures) 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 5. Select the domain.

- Choose from the primary chronic conditions, chronic or potentially disabling conditions, behavioral health conditions, or COVID-19 in the **Domain** tab.[37]

Step 6. Select the condition/service.

- For all selections other than preventive services in the **Measure** tab, choose one of chronic conditions or COVID-19 in the Condition/Service tab. A user may not select more than one

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

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 7. 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 five age groups (under 65, 65+[38], 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 six racial and ethnic groups (All, White, Black, Asian/Pacific Islander, Hispanic, American Indian/Alaska Native) in the **Race and Ethnicity** tab. Note that beginning 2020 the race option of "Other" is no longer available under the MBISG race groups.
- Choose between five original reasons for entitlement groups (All, Old Age & Survivor's Insurance, Disability Insurance Benefits [DIB], End-Stage Renal Disease [ESRD], both DIB & ESRD) in the **Medicare Eligibility** tab.

Step 8. 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.

Step 9. Select a comparison sex, age, eligibility status, original reason for entitlement, 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, original reason for entitlement, or race and ethnicity. Choose to compare data between two sex categories (male or female) with the **Comparison Sex** tab. Select one of five age groups (<65, 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, five different original reason for entitlement groups (All, Old Age & Survivor's Insurance, Disability Insurance Benefits [DIB], End-Stage Renal Disease [ESRD], both DIB & ESRD) in the **Comparison Medicare Eligibility** tab or six different racial and ethnic groups (All, White, Black, Asian/Pacific Islander, 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:

[38] The 65+ age group was added for the 2021 Medicare data release and forward.

- 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.

10.3 Social Determinants of Health View

The SDOH View allows users to build queries step-by-step, following the steps below.

Step 1. Select the year for your query.

- Choose 2020 in the **Year** tab.

Step 2. Select the State/Territory.

- Choose any state/territory from the **State/Territory** drop-down menu.

Note: Not selecting any state shows county-level SDOH data for all counties.

Step 3. Select the County.

- Choose any county from the **County** drop-down menu.

Step 4. Select the Census Tract.

- Choose any census tract from the **Census Tract** drop-down menu. Users can use the link named "Look up Census Tract ID for your location!" (this link will open the "Find Address Geographies" page at the US Census Bureau website) at the top of the MMD tool to search for the census tract number of an address. To search for the census tract number, users can type the address, click on "Get Results" button, and scroll down to the "Census Tracts" section of the result page to locate the census tract name/number.

Step 5. Select the Domain.

- Choose from Educational Attainment, Healthcare Access and Quality, Environment, and Social and Community Context from the **Domain** drop-down menu.

Step 6. Select the Measure.

- Choose one of the measures from the **Measure** drop-down menu. Similar to the Population View and Hospital View, users can also download the map and the underlying data in the SDOH view.

Similar to the Population View and Hospital View, users can also download the map and the underlying data in the SDOH view.

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, race and ethnicity distribution, insurance rate by insurance type and age group, unemployment rate, percent below the poverty level, , 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. Due to the size of some American territories, County and State Profile Data is not available for the US Virgin Islands, Guam, American Samoa, and Northern Marianas.

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 FFS Population view of the MMD Tool uses 2012 through 2022 CMS administrative claims data for Medicare beneficiaries enrolled in the FFS program, which are available from CMS through the CCW.[39] 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
- 100% Geographic Variation Database Inpatient Claim File

The following beneficiary characteristics from the MBSF[40] 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[41]

[39] See www.ccwdata.org. Data dictionaries for CMS RIFs can be found at www.resdac.org.
[40] The data dictionary is available at: https://ccwdata.org/web/guest/data-dictionaries
[41] Research Data Assistance Center (ResDAC). Identifying Dual Eligible Medicare Beneficiaries in the Medicare Beneficiary Enrollment Files. Minneapolis, MN: ResDAC. October 25, 2018. https://resdac.org/articles/identifying-dual-eligible-medicare- beneficiaries-medicare-beneficiary-enrollment-files

- Race and ethnicity: Race or ethnicity of the beneficiary[42]
- Original reason for entitlement: Original reason for the beneficiary's Medicare entitlement

The MA Population view of the MMD Tool uses 2018 inpatient encounter data for Medicare beneficiaries enrolled in the Medicare Advantage (MA) program, which are available from CMS through the Chronic Conditions Warehouse. These Medicare encounter files were leveraged for the MA analysis, along with CMS's Master Beneficiary Summary File (MBSF) and the Office of Enterprise and Data Analytics' (OEDA) Medicare Advantage Encounter File Provisional Analytical Data (PAD).

A.2 Expanded Methodology

A.2.1 Prevalence Rates and Total Costs

The chronic conditions are identified using the International Classification of Diseases, 9th edition, (ICD-9) diagnosis codes for claims with service dates before October 1, 2015, and the International 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.[43, 44] 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, 2017, 2018, 2019, 2020, 2021, or 2022), 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

[42] Specifically, this is the RTI_RACE_CD variable in CCW's MBSF dataset for years 2012-2019 and the MBISG race indicator for years 2020 and forward. For 2012-2019, the race indicator is based on the variable imputed race definition created by the Research Triangle Institute (RTI). The RTI race/ethnicity classifications are: Non-Hispanic White, Black or African American, Asian/Pacific Islander, Hispanic, American Indian/Alaska Native, and Other. The MBISG methodology was developed by RAND in coordination with CMS OMH and aims to improve the accuracy of racial classification for Medicare beneficiaries. More information about this methodology can be found at: Imputation of race/ethnicity to enable measurement of HEDIS performance by race/ethnicity - PMC (nih.gov). The MBISG race/ethnicity classification includes: American Indian or Alaska Native [AI/AN], Asian or Pacific Islander [API], Black, Hispanic, and White. Due to this change in race indicators, the "Other" option for MBISG race/ethnicity is no longer available in 2020 and forward.

[43] 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.

[44] 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

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, 2017, 2018, 2019, 2020, 2021 and 2022.

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 (FFS)

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[45]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
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	6,936,964	7,165,535	7,183,601	7,162,692	7,335,526
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	22,522,630	24,134,883	26,323,945	28,989,227	31,294,709
Total Medicare Beneficiaries Included in Analysis	=	34,066,594	34,242,754	34,047,660	34,061,529	33,965,009	33,706,997	33,471,190	33,130,311	32,394,361	30,889,191	29,608,938

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

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, original reason for entitlement, 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, 2017, 2018, 2019, 2020, 2021, 2022). 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, 2017, 2018, 2019, 2020, 2021 and 2022.

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

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[46]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
Exclude Beneficiaries without Continuous Enrollment throughout Year	(-)	50,259	58,035	59,949	58,139	60,154	61,945	72,383	74,169	55,025	49,959	53,722
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	22,850,163	24,514,516	26,757,786	29,440,232	31,785,704
Total Medicare Beneficiaries Included in Analysis	=	38,804,336	39,105,909	39,023,942	39,183,425	40,078,550	40,047,917	40,008,238	39,842,044	39,089,096	37,550,919	36,399,747

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

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.[47] 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.[48] 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.

A.2.2 Hospitalization Rates

The Fee-for-Service population 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, 2017, 2018, 2019, 2020, 2021, or 2022). 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, 2017, 2018, 2019, 2020, 2021, and 2022.

The Medicare Advantage hospitalization rate is calculated by identifying beneficiaries with an inpatient stay at short-term acute care facilities that are present in the inpatient Medicare encounter data and OEDA's PAD file. The analysis population includes 100 percent of Medicare beneficiaries continuously enrolled in Medicare Advantage for the selected year (2018). Additionally, beneficiaries who died during the year but otherwise were continuously enrolled up until the date of death, as well as beneficiaries who started enrollment in the middle of a 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 FFS plan. The number of 2018 total Medicare enrollees is 62,930,784.

[47] 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.
[48] 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

With FFS beneficiaries excluded as stated above, the study population for Medicare Advantage beneficiaries included in the MA analysis is 21,083,524 beneficiaries.

Table A.3. Deriving Analysis Population for Hospitalizations Measure (FFS)

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[49]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
Exclude Beneficiaries without Continuous Enrollment in Part A throughout Year	(-)	448,203	457,644	462,616	472,031	470,499	486,018	482,968	493,558	460,288	452,807	463,087
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	22,808,064	24,468,298	26,710,705	29,391,705	31,734,826
Total Medicare Beneficiaries Included in Analysis	=	38,437,207	38,740,138	38,656,808	38,807,593	39,701,034	39,662,937	39,639,752	39,468,873	38,730,914	37,196,598	36,041,260

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.[50] Table A.4 provides a side-by-side comparison of the CDC and CCW methodologies for cardiovascular diseases. The hospitalization rates for the remaining chronic conditions are based on the diagnosis codes from the CCW.

[49] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.
[50] Hospitalization rates for past years can be viewed at: http://nccd.cdc.gov/DHDSPAtlas/viewer.aspxhttps://nccd.cdc.gov/DHDSPAtlas/

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

Hospitalization Measures [1] [3]			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 Dysrhyt hmia	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.html. 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.[51] 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.[52] PQI 2 and 10 were retired in 2019; therefore, data for these variables will not be available in 2019 data-onwards. AHRQ's QI SAS software with annual update was used for the computations.[53]

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, 2017, 2018, 2019, 2020, 2021, or 2022). These beneficiaries are 18 years old or older and are enrolled in Medicare Part A.[54] 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, 2017, 2018, 2019, 2020, 2021, and 2022.

[51] 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
[52] AHRQ. Prevention Quality Indicators Technical Specifications, Version v2022. Available at AHRQ QI: PQI Technical Specifications Updates
[53] AHRQ SAS QI Software. https://www.qualityindicators.ahrq.gov/Software/SAS.aspx
[54] 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.[55]

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

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[56]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
Exclude Beneficiaries without Continuous Enrollment in Part A throughout Year	(-)	448,203	457,644	462,616	472,031	470,499	486,018	482,968	493,558	460,288	452,807	463,087
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	22,808,064	24,468,298	26,710,705	29,391,705	31,734,826
Exclude Beneficiaries younger than 18	(-)	2,116	2,053	1,933	1,806	1,657	1,653	1,582	1,531	1,436	1,367	1,250
Total Medicare Beneficiaries Included in Analysis	=	38,435,091	38,738,085	38,654,875	38,805,787	39,701,034	39,661,284	39,638,170	39,467,342	38,729,478	37,195,231	36,040,010

[55] See announcement from AHRQ on this subject: https://www.qualityindicators.ahrq.gov/News/PQI13_Retirement_Announcement.pdf
[56] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.

A.2.4 Readmission Rates

The readmission rate among beneficiaries with an inpatient claim and a principal diagnosis code of acute myocardial infarction (AMI), or heart failure (HF) is calculated using CMS's risk-standardized readmission measures methodology.[57]

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, 2017, 2018, 2019, 2020, 2021, or 2022). 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 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.[58] These hospital-level rates are then aggregated for each set of beneficiary characteristics for the Population View.

[57] 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

[58] 2015 Condition-Specific Measures Updates and Specifications Report: Hospital-Level 30-Day Risk-Standardized Readmissions Measures (Version 8.0).

A.2.5 Mortality Rates

The mortality rate among beneficiaries with an inpatient claim and a principal diagnosis code of AMI or HF is calculated using CMS's risk-standardized mortality measures methodology.[59]

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, 2017, 2018, 2019, 2020, 2021, or 2022). 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 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.[60] 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

[59] 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

[60] 2013 Measures Updates and Specifications: Acute Myocardial Infarction, Heart Failure, and Pneumonia 30-Day Risk- Standardized Mortality Measure (Version 7.0).

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, 2017, 2018, 2019, 2020, 2021, or 2022). 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.6 presents how the population used to calculate this measure are derived at the national level for the years 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, and 2022.

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

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[61]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
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	6,936,964	7,165,535	7,183,601	7,162,692	7,335,526
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	22,522,630	24,134,883	26,323,945	28,989,227	31,294,709
Total Medicare Beneficiaries Included in Analysis	=	34,066,594	34,242,754	34,047,660	34,061,529	33,965,009	33,706,997	33,471,190	33,130,311	32,394,361	30,889,191	29,608,938

ED rates are calculated using guidance provided by the ResDAC.[62] Table A.7 provides the list of revenue center codes needed to determine a visit to the ED.

[61] This count excludes beneficiaries with duplicate records in a year, as well as those with null or zero identifiers.
[62] Research Data Assistance Center (ResDAC). How to Identify Hospital Claims for Emergency Room Visits in the Medicare Claims Data. Minneapolis, MN: ResDAC. July 30, 2015. https://resdac.org/articles/how-identify-hospital-claims-emergency- room-visits-medicare-claims-data

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.

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, 2017, 2018, 2019, 2020, 2021, or 2022). 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, 2017, 2018, 2019, 2020, 2021, and 2022.

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, 2017, 2018, 2019, 2020, 2021, and 2022. 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 (FFS)

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[63]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
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	5,185,285	5,358,875	5,514,844	5,555,195	5,721,619
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	22,568,843	24,174,419	26,764,725	29,447,409	31,780,329
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	2,482,042	2,419,510	2,434,823	2,284,093	2,136,164
Total Medicare Beneficiaries Included in Analysis	=	32,486,930	32,885,420	32,816,534	32,966,351	33,017,668	32,955,844	32,694,614	32,477,925	31,187,515	29,754,413	28,601,061

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

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, 2017, 2018, 2019, 2020, 2021, and 2022. 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.

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

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[64]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
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	5,185,285	5,358,875	5,514,844	5,555,195	5,721,619
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	22,568,843	24,174,419	26,764,725	29,447,409	31,780,329
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	31,627,918	31,320,368	31,187,506	29,753,057	28,588,417
Total Medicare Beneficiaries Included in Analysis	=	3,132,663	3,124,971	3,210,771	3,306,754	3,333,923	3,353,806	3,548,738	3,577,067	2,434,832	2,285,449	2,148,808

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

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, 2017, 2018, 2019, 2020, 2021, and 2022. In addition to the enrollment requirements described above, this service also requires beneficiaries to be aged 50 or above.

Table A.10. Deriving Analysis Population for Colorectal Cancer Screening (FFS)

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[65]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
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	5,185,285	5,358,875	5,514,844	5,555,195	5,721,619
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	22,568,843	24,174,419	26,764,725	29,447,409	31,780,329
Exclude Beneficiaries aged less than 50	(-)	2,377,889	2,324,194	2,202,803	2,092,591	1,984,802	1,889,176	1,788,313	1,656,337	1,566,152	1,396,040	1,244,837
Total Medicare Beneficiaries Included in Analysis	=	32,927,468	33,238,227	33,248,253	33,466,989	33,528,326	33,448,390	33,388,343	33,241,098	32,056,186	30,642,466	29,492,388

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

Table A.11 presents the derivation of study population for *Mammogram Screening* at the national level for the years 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, and 2022. In addition to the enrollment requirements described above, this service also requires beneficiaries to be female and aged 35 or above.

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

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[66]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
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	5,185,285	5,358,875	5,514,844	5,555,195	5,721,619
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	22,568,843	24,174,419	26,764,725	29,447,409	31,780,329
Exclude Male Beneficiaries	(-)	15,709,213	15,825,803	15,776,981	15,803,970	15,587,429	15,490,083	15,394,005	15,249,341	15,331,581	14,599,063	13,989,856
Exclude Female Beneficiaries aged less than 35	(-)	285,742	280,525	263,121	246,156	231,041	214,715	200,805	183,831	184,554	165,872	148,314
Total Medicare Beneficiaries Included in Analysis	=	19,310,402	19,456,093	19,410,954	19,509,454	19,694,658	19,632,768	19,581,846	19,464,263	18,106,203	17,273,571	16,599,055

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

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, 2017, 2018, 2019, 2020, 2021, and 2022. In addition to the enrollment requirements described above, this service also requires beneficiaries to be female.

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

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[67]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
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	5,185,285	5,358,875	5,514,844	5,555,195	5,721,619
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	22,568,843	24,174,419	26,764,725	29,447,409	31,780,329
Exclude Male Beneficiaries	(-)	15,709,213	15,825,803	15,776,981	15,803,970	15,587,429	15,490,083	15,394,005	15,249,341	15,331,581	14,599,063	13,989,856
Total Medicare Beneficiaries Included in Analysis	=	19,596,144	19,736,618	19,674,075	19,755,610	19,925,699	19,847,483	19,782,651	19,648,094	18,290,757	17,439,443	16,747,369

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

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, 2017, 2018, 2019, 2020, 2021, and 2022. In addition to the enrollment requirements described above, this service also requires beneficiaries to be male and aged 50 or above.

Table A.13. Deriving Analysis Population for Prostate Cancer Screening (FFS)

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[68]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
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	5,185,285	5,358,875	5,514,844	5,555,195	5,721,619
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	22,568,843	24,174,419	26,764,725	29,447,409	31,780,329
Exclude Female Beneficiaries	(-)	19,281,908	19,288,648	19,097,826	19,042,085	19,087,236	18,900,968	18,716,858	18,477,648	18,290,748	17,439,431	16,747,358
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	971,096	905,821	868,775	784,640	708,796
Total Medicare Beneficiaries Included in Analysis	=	14,752,026	15,030,759	15,174,271	15,396,705	15,358,807	15,417,572	15,488,702	15,513,966	14,462,815	13,814,435	13,281,071

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

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, 2017, 2018, 2019, 2020, 2021, and 2022. In addition to the enrollment requirements described above, this service also requires beneficiaries to be female and aged between 30 and 65.

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

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[69]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
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	5,185,285	5,358,875	5,514,844	5,555,195	5,721,619
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	22,568,843	24,174,419	26,764,725	29,447,409	31,780,329
Exclude Male Beneficiaries	(-)	15,709,213	15,825,803	15,776,981	15,803,970	15,587,429	15,490,083	15,394,005	15,249,341	15,331,581	14,599,063	13,989,856
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	15,396,364	15,364,505	15,411,412	14,876,611	14,471,789
Total Medicare Beneficiaries Included in Analysis	=	4,240,716	4,305,583	4,365,135	4,429,295	4,424,211	4,380,499	4,386,287	4,283,589	2,879,345	2,562,832	2,275,580

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

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, 2017, 2018, 2019, 2020, 2021, and 2022.

Table A.15. Deriving Analysis Population for Preventive Services Measure (FFS)

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[70]		53,597,183	55,277,442	56,861,574	58,416,170	59,818,481	61,251,808	62,930,784	64,430,729	65,901,907	67,041,110	68,239,173
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	5,185,285	5,358,875	5,514,844	5,555,195	5,721,619
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	22,568,843	24,174,419	26,764,725	29,447,409	31,780,329
Total Medicare Beneficiaries Included in Analysis	=	35,305,357	35,562,421	35,451,056	35,559,580	35,513,128	35,337,566	35,176,656	34,897,435	33,622,338	32,038,506	30,737,225

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

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 Inpatient Admission Measures

The analysis population for FFS inpatient admission measures (i.e., the admission rates by admission type, admission rates by discharge destination, average inpatient days and average Medicare reimbursement) includes 100 percent of Medicare beneficiaries in the Geographic Variation Database (GVDB) who were continuously enrolled in Medicare FFS Parts A for the selected year. Additionally, beneficiaries who died during the year but otherwise were continuously enrolled up until the date of death, as well as beneficiaries who first became eligible for Medicare in the year and were continuously enrolled from the enrollment 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.16 presents how the population used to calculate these measures is derived at the national level for the years 2012 through 2022.

Table A.16. Deriving Analysis Population for Inpatient Measures (FFS)

Steps to Create the Analysis Population	Formula	Number of Beneficiaries										
		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total Medicare Enrollees[71]		53,540,264	55,206,238	56,767,788	58,294,195	59,818,481	61,183,250	62,873,352	64,424,342	65,843,057	66,962,061	68,239,173
Exclude Beneficiaries without Continuous Enrollment in Part A throughout Year	(-)	451,010	457,486	458,644	464,097	470,499	480,575	479,798	492,019	456,815	449,701	463,087
Exclude Beneficiaries with Enrollment in Medicare Advantage	(-)	14,554,559	15,907,314	17,484,881	18,773,034	19,646,948	21,100,901	22,807,065	24,469,424	26,710,561	29,391,389	31,734,826
Total Medicare Beneficiaries Included in Analysis	=	38,534,695	38,841,438	38,824,263	39,057,064	39,701,034	39,601,774	39,586,489	39,462,899	38,675,681	37,120,971	36,041,260

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

The analysis population for MA impatient measures (i.e., the admission rates by admission type and Average Inpatient Days per Admission) includes 100 percent of Medicare beneficiaries continuously enrolled in Medicare Advantage program for the selected year (2018). Additionally, beneficiaries who died during the year but otherwise were continuously enrolled up until the date of death, as well as beneficiaries who started enrollment in the middle of a year but were continuously enrolled from that date to the end of the year, are included in the analysis population. We excluded Medicare beneficiaries with any Medicare FFS enrollment during the year. The number of 2018 total Medicare enrollees is 62,930,784. With FFS beneficiaries excluded as stated above, the study population for Medicare Advantage beneficiaries included in the MA analysis is 21,083,524 beneficiaries.

A.2.10 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 Medicare beneficiaries continuously enrolled in Medicare FFS Parts A and B for the selected

Table A.17. 2012 Age Weights for Prevalence Measure (FFS)

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 2021. 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)
- Race and Ethnicity: (5-Year Trailing Average)
- Insurance Coverage by Type and Age Group: (5-Year Trailing Average)
- Poverty Status: (5-Year Trailing Average)
- English Proficiency: (5-Year Trailing Average)
- Unemployment Rate: (5-Year Trailing Average)
- Senior Unemployment Rate: (5 Year Trailing Average)

Data files for these measures were downloaded from the American Fact Finder website for years 2012-2017 and from the U.S. Census Bureau directly for years 2018 and beyond.[72] 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.[73] 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.18. 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 2021 inflation-adjusted dollars) by household size	
Median Household Income	Median household income in the past 12 months (in 2021 inflation-adjusted dollars)	
Poverty Status	Population with income below poverty level in the past 12 months	Total population for whom poverty status is determined

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

Measure	Numerator Description	Denominator Description
Insurance Coverage by Insurance Type and Age Group	Total population with a given insurance type, grouped by age (0-17, 18-64, 65+) [74]	Total population, grouped by age (0-17, 18-64, and 65+)
Percent of Population by Race and Ethnicity	Population identifying as ethnically "Hispanic", regardless of self-identified race, is considered "Hispanic", and all others are considered their self-identified race	Total population
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

**County-level proficiency data only available through 2015*

[74] Some insurance types as reported in the ACS are grouped together in the MMD Tool. Specifically, "Tricare/Military" and "VA" are grouped into "Tricare/Military/VA"; "Employer and Direct" is grouped with "Employer" and "Employer and Medicare", and "Medicare and Direct" is grouped with "Medicare".

Appendix B: Expanded Data and Methodology - Hospital View

B.1 Data

The Hospital View is based on the 2013 through 2022 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.[75]

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.

Table B.1. List of AHRQ's PSIs

PSI	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

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;

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

- 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.[76] The standardized infection ratio (SIR) is calculated by dividing the number of observed events by the number of predicted events.[77] 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.

[76] 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

[77] 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

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

B.2.4 Hospital Value-Based Purchasing (HVBP)[78]

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. Prior to the 2023 update, the MMD tool included data for each of these domains as well as the aggregated Total Performance Score (TPS). Due to lack of updated data, starting in 2023 the tool only includes scores in the Clinical Care and Efficiency domains.

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 compared 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.

[78] https://qualitynet.cms.gov/inpatient/hvbp Accessed on July 3, 2018.

- **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 overall score for each domain.

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.3 provides a list of IPFQR Measures.

Table B.3. 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_2	Alcohol Use Brief Intervention Provided or Offered

Measure ID	Measure Description
SUB_2a	Alcohol Use Brief Intervention
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
MedCont	Medication Continuation Following Inpatient Psychiatric Discharge

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.4 provides a list of PCHQR measures and the categories that they fall under.

Table B.4. List of PCHQR Measures

Measure Category	Measure ID	Measure Description
Oncology Care	PCH-15	Plan of Care for Pain – Medical Oncology and Radiation Oncology
Exempt Cancer Hospital Quality Reporting	PCH_26_SIR	Clostridium Difficile (C.Diff): SIR
	PCH_27_SIR	MRSA Bacteremia: SIR
	PCH_6_SIR	SSI - Colon Surgery: SIR
	PCH_7_SIR	SSI - Abdominal Hysterectomy: SIR
	PCH_28_FAC_ADHPCT	Influenza Vaccination Coverage among Healthcare Personnel: Adherence Rate
	PCH_38_FAC_ADHPCT	COVID-19 Primary Series Vaccination Coverage among Healthcare Personnel: Adherence Rate
	PCH_4_SIR	Central Line-Associated Bloodstream Infection (CLABSI): SIR
	PCH_5_SIR	Catheter-Associated Urinary Tract Infections (CAUTI): SIR

B.2.7 Effective Care

Timely and effective care measures show how often or how quickly hospitals provide care that fosters the best results for patients with certain conditions based on existing research. This category is also known as process of care measures. Table B.5 provides a list of effective measures and the categories that they fall under.

Table B.5. List of Effective Care Measures

Measure ID	Measure Description
SEP_1	Severe Sepsis and Septic Shock
ED_2_Strata_1	Median admit decision time to time of departure from the emergency department for emergency department patients admitted to inpatient status
STK_02	Percentage of ischemic stroke patients prescribed or continuing to take antithrombotic therapy at hospital discharge
STK_03	Percentage of ischemic stroke patients with atrial fibrillation/flutter who are prescribed or continuing to take anticoagulation therapy at hospital discharge
STK_05	Percentage of ischemic stroke patients administered antithrombotic therapy by the end of hospital day 2
STK_06	Percentage of ischemic stroke patients who are prescribed or continuing to take statin medication at hospital discharge
VTE_1	Percentage of patients that received VTE prophylaxis after hospital admission or surgery
VTE_2	Percentage of patients that received VTE prophylaxis after being admitted to the intensive care unit (ICU)
HCP_COVID_19	Percentage of healthcare personnel who completed COVID-19 primary vaccination series

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.

Disability Insurance Benefits are any employee benefits that provides income replacement and/or job protection to employees who are unable to work due to illness or accident.

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[79] 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 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

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

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.

Old-Age, Survivor's, and Disability Insurance (OASDI) is the monthly benefits provided to qualified retired and disabled workers and their dependents and to survivors of insured workers

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.[80] 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.[81] 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."

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.

[80] 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

[81] U.S. Census Bureau. Geographic Terms and Concepts. Washington, DC: Census Bureau. Accessed January 2015. https://www.census.gov/topics/housing/housing-patterns/about/core-based-statistical-areas.html