Medicare Data for the Fee-for-Service Geographic Variation Public Use File: A Methodological Overview

May 2024 Update

Introduction

Federal policymakers and health researchers have long recognized that the amount and quality of the health care services that Medicare beneficiaries receive varies substantially across different regions of the United States. Much of that variation does not appear to be caused by differences in beneficiaries' health, and one widely publicized estimate asserted that as much as 30 percent of Medicare expenditures may be unnecessary.[1]

The Office of Enterprise Data and Analytics within the Centers for Medicare & Medicaid Services (CMS) has developed a public use file, the Fee-for-Service Geographic Variation Public Use File (FFS GV PUF), to support further analysis of this important issue. This public use file is based primarily on information from CMS's Chronic Conditions Data Warehouse (CCW), which contains 100 percent of Medicare claims for beneficiaries who are enrolled in the fee-for-service (FFS) program as well as enrollment and eligibility data. The FFS GV PUF covers calendar years 2007-2022 and has information on demographics, spending, and service utilization for Medicare beneficiaries in different parts of the country. The FFS GV PUF also incorporates a variety of quality indicators that can be used to analyze relationships between Medicare utilization and quality of care.

The May 2024 update to the FFS GV PUF includes data for 2007-2022.

This overview is divided into the following six sections:

1. Key Data Sources
2. Study Population
3. Risk Adjustment and Standardization of Spending
4. Payment Reduction
5. Utilization Measures
6. Quality Measures

[1] John Wennberg et al. *Tracking the Care of Patients with Severe Chronic Illness – The Dartmouth Atlas of Health Care 2008*, The Dartmouth Institute for Health Policy and Clinical Practice.

1. Key Data Sources

The primary data source for these data is CMS's Chronic Conditions Data Warehouse (CCW). The CCW contains 100 percent of Medicare claims for beneficiaries who are enrolled in the FFS program as well as enrollment and eligibility data. The CCW was designed as a database to support research on chronically ill beneficiaries, so it also contains other valuable features, such as a unique identifier for each beneficiary that makes it possible to track spending and utilization for individual beneficiaries over time and flags that indicate if a beneficiary has one or more of 30 specific chronic conditions.

The detailed nature of the CCW claims data makes it possible to analyze differences in cost and/or utilization for specific settings of care or types of services. Some of the settings include inpatient hospital, outpatient hospital, multiple post-acute care settings (long-term care hospital, inpatient rehabilitation facility, skilled nursing facility, and home health agency), hospice, physicians, laboratories, and suppliers of durable medical equipment.

For years 2014-2022, physician services are defined using the Restructured BETOS Classification System (RBCS)[2], which groups services into eight major categories: evaluation and management (E&M), procedures, treatments, imaging, laboratory tests, durable medical equipment (DME), anesthesia, and other. The total number of distinct RBCS codes is much larger – about 270 – when you count the numerous sub-groupings within those major categories. See Appendix 2 for the complete list of RBCS categories and subcategories.

For 2007-2013, physician services are defined using the historical BETOS classification scheme, which groups services into six major categories: E&M, procedures, imaging, laboratory tests, DME and other. The FFS GV PUF uses BETOS for these years of data since the RBCS covers services beginning in 2014.

The FFS GV PUF also incorporates several quality measures that were derived from the Prevention Quality Indicators (PQIs) measure set, which is publicly available software that was developed by the Agency for Healthcare Research and Quality (AHRQ)[3] and uses administrative data to measure hospital admission rates for ambulatory care sensitive conditions. These measures are well-known to health care researchers and have historically been endorsed by the National Quality Forum through FY 2021[4, 5].

[2] https://data.cms.gov/provider-summary-by-type-of-service/provider-service-classifications/restructured-betos-classification-system
[3] https://www.qualityindicators.ahrq.gov/Modules/pqi_resources.aspx
[4] https://www.qualityindicators.ahrq.gov/Modules/list_ahrq_qi.aspx
[5] Note that as of FY 2022, AHRQ no longer seeks the re-endorsement of the National Quality Forum for the PQIs. More information can be found at: https://qualityindicators.ahrq.gov/Downloads/News/AHRQ_Rationale4notseekingNQFendorsement-May2021.pdf

In addition to the quality measures described above, the FFS GV PUF also includes the number of times that Medicare beneficiaries visited hospital emergency departments and all-cause hospital 30-day readmission rates.

2. Study Population

Since the primary goal of the FFS GV PUF is to make it easier to analyze differences in health care utilization and spending for Medicare beneficiaries living in different parts of the United States, the FFS GV PUF excludes certain categories of Medicare beneficiaries to make those comparisons as meaningful as possible.

Table 1 shows the number and percent of beneficiaries excluded, by year. The same exclusions are applied to each year of the data. Note that whether individual beneficiaries were part of the study population could vary from year to year, depending on whether and when one of the exclusions described below applied to them.

First, beneficiaries who had both Part A and Part B coverage and were enrolled at any point during the year in a Medicare Advantage (MA) plan are excluded.[6] (There were approximately 31.3 million beneficiaries in MA plans in 2022, about 45.9 percent of the overall total.) [7]

Second, beneficiaries who were enrolled at any point in the year in Part A only or Part B only (roughly 7.2 million in 2022, about 10.6 percent of the overall total) are excluded. Since those beneficiaries are enrolled in only one part of Medicare, per-capita spending for those beneficiaries cannot be compared directly to spending for beneficiaries that are enrolled in both Part A and Part B.

Although the FFS GV PUF reports data for beneficiaries of all ages, the data are also reported separately for two age groups: beneficiaries who were under the age of 65 and received Medicare because they were either disabled or had end-stage renal disease (approximately 3.3 million in 2022), and beneficiaries aged 65 and older (nearly 26.4 million in 2022). The data are reported separately by age group because beneficiaries under 65 differ in numerous respects from the over-65 population and could have different health service needs that are difficult to adjust for across geographic regions.

It is also important to note that the analytic files do include beneficiaries who died during the calendar year (about 1.9 percent of the study population) as long as they were not excluded for one of the reasons outlined above.

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[6] Note that in the FFS GV PUF, the number of MA beneficiaries reported is the population of beneficiaries who had Part A and Part B coverage and were enrolled in an MA plan for the entire time they were eligible, as opposed to beneficiaries who were enrolled in MA at any point during the year.

[7] For information on beneficiaries enrolled in a MA plan during the year, please see the Medicare Advantage Geographic Variation Public Use File. https://data.cms.gov/summary-statistics-on-use-and-payments/medicare-geographic-comparisons/medicare-advantage-geographic-variation-national-state

In sum, the study population for the FFS GV PUF is comprised of individuals who have both Part A and Part B coverage and are fully enrolled in Medicare's FFS program. Individuals who have both Part A and Part B coverage can enroll in either the FFS program or an MA plan, and the share enrolled in MA plans has risen steadily in recent years. The FFS GV PUF therefore includes three sets of enrollment figures – the total number of beneficiaries with Part A and Part B, the total number of MA beneficiaries, and the total number of FFS beneficiaries (i.e., the study population) – to help users understand what share of the overall Medicare population for a given geographic area is described in the file.

Table 2 provides some basic demographic information about the beneficiaries.

Table 1: Study Population in the FFS GV PUF

	2014		*2017*		*2020*		*2022*	
	Count	**Percent**	**Count**	**Percent**	**Count**	**Percent**	**Count**	**Percent**
Total Medicare Beneficiaries	56,767,775	100%	61,183,227	100%	65,843,042	100%	68,192,489	100%
Beneficiaries with Parts A and B	49,302,821	86.9%	53,301,510	87.1%	57,338,473	87.1%	59,319,668	87.0%
FFS Study Population	33,462,969	58.9%	33,725,800	55.1%	32,407,829	49.2%	29,639,955	43.5%
MA-Equivalent Study Population	15,839,852	27.9%	19,575,710	32.0%	24,930,644	37.9%	29,679,713	43.5%
Both FFS and MA Enrollment	1,431,022	2.5%	1,275,628	2.1%	1,400,223	2.1%	1,641,286	2.4%
Other (e.g., Part A Only or Part B Only)	6,033,932	10.6%	6,606,089	10.8%	7,104,346	10.8%	7,231,535	10.6%
Beneficiaries in Study Population that Died during the Year	1,454,528	2.6%	1,436,516	2.3%	1,538,096	2.3%	1,305,031	1.9%

Note: Percentages may not sum to totals because of rounding.

Table 2: Demographics of Beneficiaries in the FFS GV PUF

		2014		*2017*		*2020*		*2022*	
		Count	**Percent**	**Count**	**Percent**	**Count**	**Percent**	**Count**	**Percent**
Total FFS Medicare Beneficiaries		33,462,969	58.9%	33,725,800	55.1%	32,407,829	49.2%	29,639,955	43.5%
By age:									
	< 40	958,710	2.9%	866,544	2.6%	733,358	2.3%	599,607	2.0%
	40 to 64	4,908,460	14.7%	4,475,273	13.3%	3,549,070	11.0%	2,659,586	9.0%
	65 to 74	14,383,910	43.0%	15,273,128	45.3%	15,329,610	47.3%	13,914,963	46.9%
	75 to 84	8,655,615	25.9%	8,750,344	25.9%	8,763,014	27.0%	8,789,676	29.7%
	85 to 94	4,085,058	12.2%	3,850,376	11.4%	3,526,300	10.9%	3,214,194	10.8%
	95+	471,216	1.4%	510,135	1.5%	506,477	1.6%	461,929	1.6%
By gender:									
	Female	18,420,120	55.0%	18,471,323	54.8%	17,666,576	54.5%	16,182,730	54.6%
	Male	15,042,849	45.0%	15,254,477	45.2%	14,741,253	45.5%	13,457,225	45.4%
By race/ ethnicity:									
	White, non-Hispanic	26,747,500	79.9%	26,834,416	79.6%	25,784,252	79.6%	23,815,035	80.3%
	African American	3,249,540	9.7%	3,129,950	9.3%	2,730,695	8.4%	2,167,909	7.3%
	Hispanic	1,953,326	5.8%	1,924,543	5.7%	1,895,341	5.8%	1,682,304	5.7%
	Asian/ Pacific Islander	783,813	2.3%	852,817	2.5%	903,018	2.8%	873,348	2.9%
	Other	728,790	2.2%	984,074	2.9%	1,094,523	3.4%	1,101,359	3.7%

Note: Percentages may not sum to totals because of rounding.

3. Risk Adjustment and Standardization of Spending

These data will help users analyze underlying differences in resource use among Medicare beneficiaries in different parts of the country. These differences reflect variation in such factors as physicians' practice patterns and beneficiaries' ability and willingness to obtain care. However, Medicare spending and utilization can vary for reasons that are not attributable to practice patterns or willingness to seek care, and two of those reasons are particularly important. First, Medicare often pays different amounts for the same service in different areas (for example, to reflect variation in local wages or input prices). Second, the health of Medicare beneficiaries also varies geographically, and those differences will clearly affect spending and utilization.

To account for those factors, the data have been modified from the CCW in two ways:

- The average risk score accounts for differences in beneficiaries' health using the risk-adjustment model that CMS uses to pay MA plans.
- Medicare's payment amounts are standardized to remove geographic differences in payment rates for individual services as a source of variation.

Risk Adjustment

CMS developed a risk-adjustment model that uses HCCs (hierarchical condition categories) to assign risk scores[8]. Those scores estimate how beneficiaries' FFS spending will compare to the overall average for the entire Medicare population. The average risk score is set at 1.0; beneficiaries with scores greater than that are expected to have above-average spending, and vice versa. Risk scores are based on a beneficiary's age and sex; whether the beneficiary is eligible for Medicaid, first qualified for Medicare on the basis of disability, or lives in an institution (usually a nursing home); and the beneficiary's diagnoses from the previous year. The HCC model was designed for risk adjustment on larger populations, such as the enrollees in an MA plan, and generates more accurate results when used to compare groups of beneficiaries rather than individuals. For more information on risk adjustment, please see:

https://www.cms.gov/medicare/payment/medicare-advantage-rates-statistics/risk-adjustment.

By standardizing payment amounts and adjusting for differences in beneficiaries' health status, these data provide a more accurate picture of how resource use varies for Medicare beneficiaries across the country.

Standardization

Payment rates were standardized using the same methodology that CMS uses to calculate its Medicare spending per beneficiary (MSPB) metric for advanced payment initiatives such as the hospital value-based purchasing program. The purpose of payment standardization is to facilitate the measurement and meaningful comparison of resource use for Medicare covered services across geographic areas and provider types. Standardization excludes geographic differences in labor

[8] https://www.cms.gov/Regulations-and-Guidance/Guidance/Manuals/Downloads/mc86c07.pdf

costs and practice expenses, measured by hospital wage indexes and geographic practice cost indexes. The FFS GV PUF uses the standardized Medicare payment amount, rather than the standardized allowed amount, to examine Medicare's various FFS payment systems and identify the factors that lead to different payment rates for the same service.

To facilitate comparisons, standardization transforms actual spending amounts into standardized amounts that exclude these adjustments. The standardized payment methodology preserves differences resulting from health care delivery choices such as service setting, type of healthcare professional providing the service, number of services provided in an encounter, and outlier cases.

For additional information on Medicare payment standardization by service type, please see the documentation on CMS Price (Payment) Standardization:

https://resdac.org/articles/cms-price-payment-standardization-overview.

4. Payment Reduction

Medicare claims use Value Codes and Other Applied Indicator Codes to indicate adjustments that were made to base payment amounts. These codes can cover a wide variety of adjustments, including sequestration, the Physician Quality Reporting System (PQRS), and the electronic health record incentive program. In most cases, the codes correspond to payment adjustments that were applied to the base Medicare payment amount which resulted in a net reduction (or increase) in Medicare's payment for a given claim or service. However, some codes reflect reductions that were applied to the base Medicare payment to the provider but were then included in separate lump-sum payments to that provider's Accountable Care Organization (ACO) or other population-based payment (PBP) program.[9] These "split payment" arrangements reflect a change in payment to a given provider for a specific service, but not a change in total Medicare spending. This means that a portion of the actual Medicare payment amount was not paid to the provider, rather it was distributed to the ACO or PBP program.

To indicate the amount that the ACO or PBP programs were paid for applicable services, two variables have been added to the FFS GV PUF:

- Total Population Based Payment Reduction Costs (i.e., the total payment reform amount that was not paid to the provider, but rather was paid to the ACO or PBP program)

- Total Population Based Payment Reduction Costs Per Capita

Addition of the payment reduction costs was applied to 2017 through 2022 data only. It is important to note that for these years, actual payment is the sum of the provider payments and the value code/ other applied payments made to ACOs or PBP program. In cases where there is no value code/ other applied payment, the provider payment amount is equal to the actual payment.

[9] For Part B non-institutional claims, the ACO/PBP payment reduction amount is obtained for each line when the line other applied indicator code = "L". For Part A and Part B institutional claims, the ACO/PBP payment reduction amount is obtained for claims when the value code = "Q1".

5. Utilization Measures

In addition to standardizing spending amounts, the FFS GV PUF includes a series of figures that measure actual utilization for certain major types of Medicare-covered services. Claims-level data from the CCW is used to calculate five metrics on all-cause hospital readmissions[10] and emergency room (ER) use:

- Total number of all-cause hospital readmissions
- All-cause hospital 30-day readmission rate (i.e., the number of readmissions divided by the total number of admissions where the beneficiary was discharged alive)
- Total number of ER visits[11]
- Total number of ER visits per 1,000 beneficiaries
- The percent of beneficiaries who had an ER visit

There are also three different types of utilization measures for each geographic region:

- The *number of times* that the beneficiaries in our study population used a particular service, expressed in terms of usage per 1,000 beneficiaries. These figures were calculated across all beneficiaries in our study population, not just the beneficiaries who used that service. The metrics that we used to measure utilization varied by the type of service and are described in more detail below.
- The *number of beneficiaries* in our study population who used a particular service.
- The *percentage of beneficiaries* in our study population who used a particular service.

These utilization measures were generated for 17 major service categories, which are defined using the claim type code and the six-digit Medicare provider number for Part A services, bill types for outpatient services, claim type code and RBCS codes for carrier claims. The service categories below are grouped by the units of measurement that we used for each service:

- The *number of covered days* of care[12] (Part A services only) that the beneficiaries in our study population used for a particular service, expressed in terms of usage per 1,000 beneficiaries.

[10] Readmissions that took place within 30 days of the initial discharge.
[11] For all metrics related to ER visits, both inpatient and outpatient visits are counted in the number of ER visits.
[12] Calculations for all hospital-related and skilled nursing facility services were based only on Medicare-covered days.

- Inpatient hospital care (including inpatient acute care hospitals paid under the Prospective Payment System (PPS), critical access hospitals (CAHs), and other inpatient hospital care[13])
- Long-Term Care Hospital (LTCHs)
- Inpatient Rehabilitation Facilities (IRFs)
- Skilled Nursing Facilities (SNFs)
- Hospice

- The *number of stays* (Part A services only),
  - We identify "stays" by ordering a beneficiary's claims by date of service and then looking for continuous, uninterrupted periods of service use within each service type, except home health (Service Types are: Acute (i.e., CAH, IPPS), IPF, IRF, LTCH, SNF, Hospice, and Other). A stay begins when a beneficiary starts using a particular type of service and ends when we cannot find another claim that continues an uninterrupted period of use for that particular type of service. For the various inpatient hospital settings (CAH, IPPS, IPF, IRF, LTCH), we group the claims into the same stay if: a) a beneficiary has two claims for the same service and the start date on the second claim comes before the end date (this is rare), or b) in the same scenario, the second claim has the same end date as the first claim. IPPS and CAH claims are the only service types that we group together into a single stay and the remaining stay counts (IRF and LTCH) are distinct. For SNF and Hospice, we employ similar rules to group claims into stays; however, SNF and Hospice also allow for the second claim to be the day after the end date on the earlier claim.

- The *number of episodes* that the beneficiaries in our study population used for a particular service, expressed in terms of usage per 1,000 beneficiaries.
  - Home Health

- The *number of visits* that the beneficiaries in our study population used for a particular service, expressed in terms of usage per 1,000 beneficiaries.
  - Home Health
  - Hospital Outpatient Services
  - Outpatient Dialysis Facilities
  - Clinics (Federally Qualified Health Centers and Rural Health Centers)

- The *number of events* (Part B services only) that the beneficiaries in our study population used for a particular service, expressed in terms of usage per 1,000 beneficiaries. We identify "events" by using each type of service (based on the subcategory of the RBCS ID[14]) that a beneficiary received on a given claim and given day.
  - Ambulatory Surgery Centers (ASCs)
  - Evaluation and Management Services

[13] This category includes hospitals such as inpatient psychiatric facilities and cancer hospitals.
[14] The RBCS ID is the Restructured BETOS Classification System ID, and more information can be found here: https://data.cms.gov/provider-summary-by-type-of-service/provider-service-classifications/restructured-betos-classification-system.

- Procedures
- Tests (laboratory and non-laboratory)
- Imaging
- Durable Medical Equipment (DME)
- Ambulance
- Treatments

Finally, the FFS GV PUF includes actual and standardized costs for "other services" that do not fit into the previous categories, but not the counts of these services due to the various services included in this field.

6. Quality Measures

The relationships between the quality, use, and cost of health care are important elements to consider when analyzing the geographic variation in Medicare spending. For example, do areas with above-average spending provide high-quality care, or is there little correlation between the two?

The statistics on hospital readmissions and ER visits discussed above are useful in examining some issues related to the quality of care, such as continuity of care and access to primary care. The FFS GV PUF has supplemented those metrics by adding dozens of other quality-related measures to support additional analyses. The FFS GV PUF contains individual quality measures from the Prevention Quality Indicators' (PQIs) measure set, which is publicly available software developed by AHRQ that uses administrative data to measure hospital admission rates for ambulatory care sensitive conditions. Due to small cell sizes for many of the measures, PQIs are not present in the county-level data.

See Appendix 1 for a complete list of the measures that we included in the data set.

Calculation of state-level scores for individual measures. The current PQI software contains a total of 17 different measures. OEDA does not use nine of those measures, either because they address issues that are not significant for the Medicare population (such as obstetric care) or because the sample size is too small. OEDA then took the remaining 8 measures, which are usually reported for an individual zip code or provider; and aggregated them at the national and state level.

These measures were aggregated by downloading the PQI software from the AHRQ website and applying it to inpatient claims. The software generates results by metropolitan statistical area (MSA); those results were then converted to the zip code level, using procedures developed by AHRQ. Finally, the results were added for all zip codes in each state. AHRQ's software was used to calculate each PQI measure separately for beneficiaries under age 65, those between the ages of 65 and 74, and those who were 75 or older (with some exceptions if the measure specifications dictated otherwise; see Appendix 1).

Appendix 1 – Quality Measures Included in the FFS GV PUF

Prevention Quality Indicators (8 measures, calculated per 100,000 beneficiaries in the specified age groups)

- Diabetes long-term complications admission rate (<65, 65-74, 75+)
- Chronic obstructive pulmonary disease or asthma in older adults admission rate (40-64, 65-74, 75+)
- Hypertension admission rate (<65, 65-74, 75+)
- Congestive heart failure admission rate (<65, 65-74, 75+)
- Bacterial pneumonia admission rate (<65, 65-74, 75+)
- Urinary tract infection admission rate (<65, 65-74, 75+)
- Asthma in younger adults (<40)
- Rate of lower extremity amputations among patients with diabetes (<65, 65-74, 75+)

Readmissions and Emergency Room Use (5 measures)

- Total number of hospital readmissions
- Hospital readmission rate
- Total number of emergency room visits
- Total number of emergency room visits per 1,000 beneficiaries
- Percentage of beneficiaries with an emergency room visit

Appendix 2 – Restructured BETOS Classification System Categories and Subcategories

For data years 2014-2022, the FFS GV PUF includes data from the following categories/subcategories of the Restructured BETOS Classification System:

Evaluation and Management (E&M)

- Behavioral Health Services
- Critical Care Services
- Ophthalmological Services
- Home Services
- Hospital Inpatient Services
- Nursing Facility Services
- Care Management/Coordination
- Observation Care Services
- Hospice/Palliation
- Emergency Department Services
- Office/Outpatient Services
- Miscellaneous

Procedures

- Anesthesia[15]
- Breast
- Cardiovascular
- Eye
- Digestive/Gastrointestinal
- Hematology
- Musculoskeletal
- Skin
- Vascular
- Other Organ Systems

Treatments

- Dialysis
- Chemotherapy
- Injections and Infusions (non-oncologic)
- Radiation Oncology
- Physical, Occupational and Speech Therapy
- Miscellaneous

[15] Anesthesia is a separate category in the RBCS but is classified under Procedures in the FFS GV PUF.

Imaging

- Computerized Tomography (CT)
- Magnetic Resonance (MR)
- Nuclear
- Ultrasound
- Standard X-Ray
- Miscellaneous

Tests

- Anatomic Pathology
- Cardiology
- General Laboratory
- Molecular Testing
- Neurologic
- Pulmonary Function
- Miscellaneous

Durable Medical Equipment (DME)

- Medical/Surgical Supplies
- Hospital Beds
- Oxygen and Supplies
- Wheelchairs
- Orthotic Devices (includes Prosthetics)
- Enteral and Parenteral Nutrition
- Drugs administered through DME
- Other DME

Other[16]

- Chiropractic Services
- Vision, Hearing and Speech

[16] Other does not include ambulance services. Ambulance services are included as a separate grouping in the FFS GV PUF and the values for ambulance services correspond to the values in the Ambulance subcategory under Other.