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

February 2023 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 Geographic Variation Public Use File (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 GV PUF covers calendar years 2007-2021 and has information on demographics, spending, and service utilization for Medicare beneficiaries in different parts of the country. We also incorporated a variety of quality indicators that can be used to analyze relationships between Medicare utilization and quality of care.

The February 2023 update to the GV PUF includes data for 2007-2021.

This overview is divided into the following seven sections:

1. Key data sources
2. Study population
3. Geographic variables
4. Risk adjustment and standardization of spending
5. Payment Reduction
6. Utilization measures
7. Quality measures

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 fee-for-service (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.

[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.

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.

Physician services are defined using the Berenson-Eggers Type of Service (BETOS) classification scheme, which groups services into six major categories: physician evaluation and management, physician procedures, imaging, laboratory tests, durable medical equipment, and other. The total number of distinct BETOS codes is much larger – about 120 – when you count the numerous sub-groupings within those major categories.

We also incorporated several quality measures that were derived from Prevention Quality Indicators (PQIs) measure set, which is publicly available software that was developed by the Agency for Healthcare Research and Quality (AHRQ)[2] 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 been endorsed by the National Quality Forum[3].

In addition to the quality measures described above, we also calculated 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 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, we created analytic files that exclude 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. We applied the same exclusions 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, we excluded beneficiaries who were enrolled in Parts A and B Medicare and Medicare Advantage (MA) plan for the entire time they were eligible during the year (there were approximately 27 million beneficiaries in Parts A and B Medicare MA plans in 2021, about 41 percent of the overall total). We also excluded beneficiaries with both FFS and MA enrollment (approximately 1.6 million in 2021, about 2.4 percent).

Second, we excluded beneficiaries who were enrolled at any point in the year in Part A only or Part B only (nearly 7.1 million in 2021, about 10.5 percent of the overall total). Since those beneficiaries are enrolled in only one part of Medicare, per-capita spending for those beneficiaries

[2] https://www.qualityindicators.ahrq.gov/Modules/pqi_resources.aspx
[3] https://www.qualityindicators.ahrq.gov/Modules/list_ahrq_qi.aspx

cannot be compared directly to spending for beneficiaries that are enrolled in both Part A and Part B.

Although we report data for beneficiaries of all ages, we also report data 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 3.7 million in 2021) and beneficiaries age 65 and older (nearly 27.2 million in 2021). We report data 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.

We would like to note that our analytic files do include beneficiaries who died during the calendar year (about 2.1 percent of the study population) as long as they were not excluded for one of the reasons outlined above.

In sum, the study population for the GV PUF is comprised of individuals who have both Part A and Part B coverage and are enrolled in Medicare's fee-for-service (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 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.

3. Geographic variables

We assigned Medicare spending to geographies based on where beneficiaries live, rather than where they received care. Hospital referral regions (HRRs), states and counties are used for the geographic units of analysis. [4] HRRs were developed by the Dartmouth Atlas of Health Care to delineate regional health care markets in the United States. See Appendix 1 for a complete list of HRRs.

The Dartmouth Atlas constructed HRRs by grouping zip codes together based on the referral patterns for tertiary care for Medicare beneficiaries. HRRs also had to have a minimum overall population of 120,000, and the residents of each HRR had to receive at least 65 percent of their hospitalizations within the HRR. There are 306 HRRs in the United States, and their boundaries often cross state lines. For example, the HRR for Memphis, Tennessee, includes parts of southeastern Missouri, eastern Arkansas, and northern Mississippi.

Although HRRs are smaller than states, they are large enough to encompass most of the care received by beneficiaries, even if they obtain care in multiple localities or counties. Our data show that 75.3 percent of Medicare expenditures in 2021 occurred in the same HRR where the beneficiary lived. Furthermore, HRRs generally have populations that are large enough to generate stable averages for comparisons of cost and utilization, even for narrowly defined

[4] https://www.dartmouthatlas.org/faq/#research-methods-faq

combinations of conditions and services. Further details regarding HRR methodology can be found on the Dartmouth Atlas web page here: https://data.dartmouthatlas.org

Table 1: Study Population in the GV PUF

	2009		*2013*		*2017*		*2021*	
	Count	**Percent**	**Count**	**Percent**	**Count**	**Percent**	**Count**	**Percent**
Total Medicare Beneficiaries	48,916,748	100.0%	55,206,238	100.0%	61,405,844	100.0%	66,962,061	100.0%
FFS Study Population	32,252,658	65.9%	33,641,801	60.9%	33,834,314	55.1%	30,900,379	46.1%
MA-Equivalent Study Population [5]	10,793,657	22.1%	14,650,723	26.5%	19,615,102	31.9%	27,363,940	40.9%
Both FFS and MA Enrollment	992,760	2.0%	1,049,352	1.9%	1,284,399	2.1%	1,634,414	2.4%
Other (e.g., Part A only or Part B only)	4,877,673	10.0%	5,864,362	10.6%	6,672,029	10.9%	7,063,328	10.5%
Total Excluded Beneficiaries	16,664,090	34.1%	21,564,437	39.1%	27,571,530	44.9%	36,061,682	53.9%
Beneficiaries in Study Population that Died during the Year	1,450,580	3.0%	1,483,291	2.7%	1,437,735	2.3%	1,422,619	2.1%

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

[5] The MA-Equivalent Population in Table 1 is not included in the FFS GV PUF reports, whereas the population of MA beneficiaries who were enrolled at any point during the year in a MA plan is included.

Table 2: Demographics of FFS Study Beneficiaries in the GV PUF

	2009		*2013*		*2017*		*2021*	
	Count	**Percent**	**Count**	**Percent**	**Count**	**Percent**	**Count**	**Percent**
Total FFS Medicare Beneficiaries	32,252,658	65.9%	33,641,801	60.9%	33,834,314	55.1%	30,900,379	46.1%
By Age:								
< 40	910,087	2.8%	990,371	2.9%	873,851	2.6%	665,782	2.2%
40 to 64	4,692,492	14.5%	5,017,361	14.9%	4,500,861	13.3%	3,071,567	9.9%
65 to 74	12,985,217	40.3%	14,166,072	42.1%	15,349,807	45.4%	14,672,190	47.5%
75 to 84	9,169,809	28.4%	8,828,218	26.2%	8,750,218	25.9%	8,688,654	28.1%
85 to 94	4,071,836	12.6%	4,170,731	12.4%	3,849,686	11.4%	3,326,468	10.8%
95+	423,217	1.3%	469,048	1.4%	509,891	1.5%	475,718	1.5%
By Sex:								
Male	14,217,354	44.1%	15,063,871	44.8%	15,304,075	45.2%	14,048,673	45.5%
Female	18,035,304	55.9%	18,577,930	55.2%	18,530,239	54.8%	16,851,706	54.5%
By Race/ Ethnicity:								
White, non-Hispanic	26,208,974	81.3%	26,901,204	80.0%	26,863,128	79.4%	24,724,269	80.0%
African American	3,086,068	9.6%	3,309,581	9.8%	3,143,292	9.3%	2,414,168	7.8%
Hispanic	1,850,901	5.7%	1,993,608	5.9%	1,999,870	5.9%	1,778,232	5.8%
Asian/ Pacific Islander	676,125	2.1%	781,309	2.3%	867,753	2.6%	886,356	2.9%
Other	430,590	1.3%	656,099	2.0%	960,271	2.8%	1,097,354	3.6%

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

4. Risk adjustment and standardization

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, we modified the data from the CCW in two ways:

- We report average hierarchical condition category (HCC) score to account for differences in beneficiaries' health using the risk-adjustment model that CMS uses to pay MA plans.
- We standardized Medicare's payment amounts 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[6]. 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.[7] 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.

CMS uses HCCs to determine the diagnosis-related portion of the risk score. For example, the HCC system for 2010 included a total of 189 conditions, with related conditions grouped into 70 disease hierarchies. One hierarchy had three different diseases that affect the liver: end-stage liver disease, cirrhosis, and chronic hepatitis. Each condition had a weight that reflects its marginal contribution to a beneficiary's total expected Medicare costs.

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

[7] Other methods of risk adjustment exist. For example, the Dartmouth Atlas has adjusted for risk in some of its research by comparing beneficiaries with the same chronic condition during the last two years of life and by comparing beneficiaries who are admitted to the hospital for the same reason. We decided to use the HCC model because it is generally regarded as the best risk-adjustment model available and is used by CMS for both MA and (in a modified form) Part D payment. However, the HCC model relies in part on diagnoses, so scores may reflect variation in physicians' practice patterns rather than beneficiaries' health status. For example, some areas with high utilization patterns may look riskier because more diagnoses will show up on claims.

Under the HCC system, CMS calculates the diagnosis-related portion of a beneficiary's risk score by adding up the weights for the most severe diagnosis that the beneficiary has in each disease hierarchy. Continuing the example above, a beneficiary with both cirrhosis (weight = 0.406) and chronic hepatitis (weight = 0.406) would receive credit only for the cirrhosis diagnosis.[8] The researchers who developed the HCC system adopted this approach after finding that having multiple conditions within a hierarchy did not increase overall patient spending substantially.

We used the risk scores to adjust spending data at the beneficiary level rather than in aggregate. As a result, the aggregate standardized, risk-adjusted spending in a region does not equal the aggregate standardized costs divided by the average HCC risk score. In addition, the HCC model was not designed to risk-adjust spending for individual services and therefore is not applied to service-level spending. The Medicare Payment Advisory Commission has used a similar approach in some of its work.[9]

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

We standardized payment rates 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. We use 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.

In order 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.

Standardization excludes geographic differences in labor costs and practice expenses, measured by hospital wage indexes and geographic practice cost indexes. Also excluded are payment adjustments from special Medicare programs not directly related to resource use for the service such as graduate medical education (GME) and indirect medical education (IME) payments, disproportionate share payments (DSH) and uncompensated care payments (for serving a large low-income and uninsured population). Adjustments for value-based purchasing (VBP) payments, penalties related to the hospital readmission reduction program (HRRP), hospital acquired

[8] The HCC model has two sets of weights: one for beneficiaries living in the community and another for beneficiaries living in an institution. This example uses the weights for a beneficiary living in the community (which happen to be identical for these two conditions).

[9] For example, see Medicare Payment Advisory Commission, *Measuring Regional Variation in Service Use*, December 2009.

condition (HAC) reduction program, and quality reporting programs are excluded. The national amount is substituted in the case of services paid on the basis of state fee schedules. [10]
For additional information on Medicare payment standardization by service type, please see the "Geographic Variation Public Use File: Technical Supplement on Standardization" available here: https://resdac.org/sites/datadocumentation.resdac.org/files/CMS%20Part%20A%20and%20Part%20B%20Price%20%28Payment%29%20Standardization%20-%20Detailed%20Methods%20%28updated%20May%202022%29.pdf

5. 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.[11] 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, we added two variables to the 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 2021 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.

6. Utilization measures

In addition to standardizing and risk-adjusting spending amounts, we also calculated a series of figures that measure actual utilization for certain major types of Medicare-covered services. We

[10] http://www.qualitynet.org/dcs/ContentServer?c=Page&pagename=QnetPublic%2FPage%2FQnetTier4&cid=1228772057350
[11] 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".

used the claims-level data from the CCW to calculate five metrics on all-cause hospital readmissions[12] 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
- Total number of ER visits per 1,000 beneficiaries
- The percent of beneficiaries who had an outpatient or inpatient ER visit

We also generate 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. We calculated these figures across all beneficiaries in our study population, not just the beneficiaries who used that particular 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

We generated these utilization measures for 16 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 BETOS codes for carrier claims. The service categories below are grouped by the units of measurement that we used for each service:

- Number of stays, number of days of care[13]
    - Inpatient hospital care (including inpatient acute care hospitals paid under the Prospective Payment System (PPS), critical access hospitals (CAHs), and other inpatient hospital care[14])
    - Long-term care hospital (LTCHs)
    - Inpatient rehabilitation facilities (IRFs)
    - Skilled nursing facilities (SNFs)
    - Hospice
- Number of episodes, number of visits

[12] We used all readmissions that took place within 30 days of the initial discharge.
[13] Our calculations for all hospital-related and skilled nursing facility services were based only on Medicare-covered days.
[14] This category includes hospitals such as inpatient psychiatric facilities and cancer hospitals.

    - Home health

- Number of visits
    - Hospital outpatient services
    - Outpatient dialysis facilities
    - Clinics (federally-qualified health centers and rural health centers)

- Number of events
    - Ambulatory surgery centers (ASCs)
    - Physician evaluation and management services
    - Physician procedures
    - Imaging
    - Durable Medical Equipment (DME)
    - Tests (laboratory and non-laboratory)
    - Ambulance
    - Other services[15]

We generated figures for the number and percentage of beneficiaries using prescription drugs that are covered under Part B. We did not calculate the number of times that beneficiaries used those drugs because of the difficulty in devising a standard way to measure their utilization.

Finally, we include 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.

7. 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. We have supplemented those metrics by adding dozens of other quality-related measures to support additional analyses. We first selected individual quality measures from the Prevention Quality Indicators' 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, we do not present the PQIs in the county-level data.

These measures have been endorsed by the National Quality Forum and are well-known to health care researchers and quality improvement organizations. See Appendix 2 for a complete list of the measures that we included in the data set.

[15] The other outpatient category includes various services such as chiropractic, vision, hearing, speech and other unclassified PTB services.

Calculation of HRR-level and state-level scores for individual measures. The current PQI software contains a total of 17 different measures. We decided not to use eight 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. We then took the remaining 9 measures, which are usually reported for an individual zip code or provider, and aggregated them at the HRR and state level.

We did this by downloading the PQI software from the AHRQ website and applying it to inpatient claims. The software generates results by metropolitan statistical area; we then followed procedures developed by AHRQ to convert those results to the zip code level. We then added the results for all zip codes in each HRR or state. We used AHRQ's software 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 2).

Appendix 1 - Hospital Referral Regions

We list HRRs by state and the name of the primary city or county within each HRR. For maps that show the specific boundaries for each HRR, please go to: https://data.dartmouthatlas.org/downloads/methods/geogappdx.pdf.

Alabama (6)	Birmingham, Dothan, Huntsville, Mobile, Montgomery, Tuscaloosa
Alaska (1)	Anchorage
Arizona (4)	Mesa, Phoenix, Sun City, Tucson
Arkansas (5)	Fort Smith, Jonesboro, Little Rock, Springdale, Texarkana
California (24)	Alameda County, Bakersfield, Chico, Contra Costa County, Fresno, Los Angeles, Modesto, Napa, Orange County, Palm Springs, Redding, Sacramento, Salinas, San Bernadino, San Diego, San Francisco, San Jose, San Luis Obispo, San Mateo County, Santa Barbara, Santa Cruz, Santa Rosa, Stockton, Ventura
Colorado (7)	Boulder, Colorado Springs, Denver, Fort Collins, Grand Junction, Greeley, Pueblo
Connecticut (3)	Bridgeport, Hartford, New Haven
Delaware (1)	Wilmington
District of Columbia (1)	Washington
Florida (18)	Bradenton, Clearwater, Fort Lauderdale, Fort Myers, Gainesville, Hudson, Jacksonville, Lakeland, Miami, Ocala, Orlando, Ormond Beach, Panama City, Pensacola, Sarasota, St. Petersburg, Tallahassee, Tampa
Georgia (7)	Albany, Atlanta, Augusta, Columbus, Macon, Rome, Savannah
Hawaii (1)	Honolulu
Idaho (2)	Boise, Idaho Falls
Illinois (13)	Aurora, Bloomington, Blue Island, Chicago, Elgin, Evanston, Hinsdale, Joliet, Melrose Park, Peoria, Rockford, Springfield, Urbana
Indiana (9)	Evansville, Fort Wayne, Gary, Indianapolis, Lafayette, Muncie, Munster, South Bend, Terre Haute
Iowa (8)	Cedar Rapids, Davenport, Des Moines, Dubuque, Iowa City, Mason City, Sioux City, Waterloo
Kansas (2)	Topeka, Wichita
Kentucky (5)	Covington, Lexington, Louisville, Owensboro, Paducah
Louisiana (10)	Alexandria, Baton Rouge, Houma, Lafayette, Lake Charles, Metairie, Monroe, New Orleans, Shreveport, Slidell
Maine (2)	Bangor, Portland
Maryland (3)	Baltimore, Salisbury, Takoma Park
Massachusetts (3)	Boston, Springfield, Worcester
Michigan (15)	Ann Arbor, Dearborn, Detroit, Flint, Grand Rapids, Kalamazoo, Lansing, Marquette, Muskegon, Petoskey, Pontiac, Royal Oak, Saginaw, St. Joseph, Traverse City

Minnesota (5)	Duluth, Minneapolis, Rochester, St. Cloud, St. Paul
Mississippi (6)	Gulfport, Hattiesburg, Jackson, Meridian, Oxford, Tupelo
Missouri (6)	Cape Girardeau, Columbia, Joplin, Kansas City, Springfield, St. Louis
Montana (3)	Billings, Great Falls, Missoula
Nebraska (2)	Lincoln, Omaha
Nevada (2)	Las Vegas, Reno
New Hampshire (2)	Lebanon, Manchester
New Jersey (7)	Camden, Hackensack, Morristown, New Brunswick, Newark, Paterson, Ridgewood
New York (10)	Albany, Binghamton, Bronx, Buffalo, East Long Island, Elmira, Manhattan, Rochester, Syracuse, White Plains
New Mexico (1)	Albuquerque
North Carolina (9)	Asheville, Charlotte, Durham, Greensboro, Greenville, Hickory, Raleigh, Wilmington, Winston-Salem
North Dakota (4)	Bismarck, Fargo, Grand Forks, Minot
Ohio (10)	Akron, Canton, Cincinnati, Cleveland, Columbus, Dayton, Elyria, Kettering, Toledo, Youngstown
Oklahoma (3)	Lawton, Oklahoma City, Tulsa
Oregon (5)	Bend, Eugene, Medford, Portland, Salem
Pennsylvania (14)	Allentown, Altoona, Danville, Erie, Harrisburg, Johnstown, Lancaster, Philadelphia, Pittsburgh, Reading, Sayre, Scranton, Wilkes-Barre, York
Rhode Island (1)	Providence
South Carolina (5)	Charleston, Columbia, Florence, Greenville, Spartanburg
South Dakota (2)	Rapid City, Sioux Falls
Tennessee (7)	Chattanooga, Jackson, Johnson City, Kingsport, Knoxville, Memphis, Nashville
Texas (22)	Abilene, Amarillo, Austin, Beaumont, Bryan, Corpus Christi, Dallas, El Paso, Fort Worth, Harlingen, Houston, Longview, Lubbock, McAllen, Odessa, San Angelo, San Antonio, Temple, Tyler, Victoria, Waco, Wichita Falls
Utah (3)	Ogden, Provo, Salt Lake City
Vermont (1)	Burlington
Virginia (8)	Arlington, Charlottesville, Lynchburg, Newport News, Norfolk, Richmond, Roanoke, Winchester
West Virginia (3)	Charleston, Huntington, Morgantown
Wisconsin (8)	Appleton, Green Bay, La Crosse, Madison, Marshfield, Milwaukee, Neenah, Wausau
Washington (6)	Everett, Olympia, Seattle, Spokane, Tacoma, Yakima
Wyoming (1)	Casper

Appendix 2 – Quality Measures Included in the GV PUF

Prevention Quality Indicators (9 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+)
Dehydration admission rate (<65, 65-74, 75+)
Bacterial pneumonia admission rate (<65, 65-74, 75+)
Urinary tract infection admission rate
Asthma in younger adults (<40)
Rate of lower extremity amputations among patients with diabetes (<65, 65-74, 75+)

Readmissions and Emergency Room Use (4 measures)

Total number of hospital readmissions
Hospital readmission rate
Total number of emergency room visits
Total number of emergency room visits per 1000 beneficiaries