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High Variation of Intravitreal Injection Rates and Medicare Anti–Vascular Endothelial Growth Factor Payments per Injection in the United States

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Purpose: To estimate geographic variation of intravitreal injection rates and Medicare anti–vascular endothelial growth factor (VEGF) drug costs per injection in aging Americans.

Design: Observational cohort study using 2013 Medicare claims database.

Participants: United States fee-for-service (FFS) Part B Medicare beneficiaries and their providers.

Methods: Medicare Provider Utilization and Payment Data furnished by the Centers for Medicare and Medicaid Services was used to identify all intravitreal injection claims and anti-VEGF drug claims among FFS Medicare beneficiaries in all 50 states and the District of Columbia in 2013. The rate of FFS Medicare beneficiaries receiving intravitreal injections and the mean Medicare-allowed drug payment per anti-VEGF injection was calculated nationally and for each state. Geographic variations were evaluated by using extremal quotient, coefficient of variation, and systematic component of variance (SCV).

Main Outcome Measures: Rate of FFS Medicare Part B beneficiaries receiving intravitreal injections (Current Procedural Terminology [CPT] code, 67028), nationally and by state; mean Medicare-allowed drug payment per anti-VEGF injection (CPT code, 67028; and treatment-specific J-codes, J0178, J2778, J9035, J3490, and J3590) nationally and by state.

Results: In 2013, the rate of FFS Medicare beneficiaries receiving intravitreal injections varied widely by 7-fold across states (range by state, 4 per 1000 [Wyoming]–28 per 1000 [Utah]), averaging 19 per 1000 beneficiaries. The mean SCV was 8.5, confirming high nonrandom geographic variation. There were more than 2.1 million anti-VEGF drug claims, totaling more than $2.3 billion in Medicare payments for anti-VEGF agents in 2013. The mean national Medicare drug payment per anti-VEGF injection varied widely by 6.2-fold across states (range by state, $242 [South Carolina]–$1509 [Maine]), averaging $1078 per injection. Nationally, 94% of injections were office based and 6% were facility based.

Conclusions: High variation was observed in intravitreal injection rates and in Medicare drug payments per anti-VEGF injection across the United States in 2013. Identifying factors that contribute to high variation may help the ophthalmology community to optimize further the delivery and use of anti-VEGF agents. *Ophthalmology 2016;■:1–6 © 2016 by the American Academy of Ophthalmology.*

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The development and introduction of anti–vascular endothelial growth factor (VEGF) has provided remarkable clinical benefits for patients with neovascular age-related macular degeneration (AMD), diabetic macular edema, and retinal vein occlusions. Numerous randomized controlled studies have demonstrated that frequent anti-VEGF injections maximize the likelihood of visual improvement in these patients.[1–5] However, the treatment is expensive because of the large numbers of patients with these problems and the cost associated with the management of these issues.[6] The financial burden of anti-VEGF agents alone increased 4-fold between 2008 and 2013, to more than $2.3 billion annually within the fee-for-service (FFS) Medicare population.[6,7]

Variation in the use of anti-VEGF agents in the treatment of neovascular AMD, diabetic macular edema, and retinal vein occlusions (injections per patient per year) compared with clinical trial recommendations has been reported recently,[8,9] but there is little information on the influence of geographic variation on intravitreal injection rates or the drug costs per anti-VEGF injection. In 2014, the Centers for Medicare and Medicaid Services (CMS) released FFS Medicare claims data detailing the volume and nature of medical services provided by United States healthcare providers and the total allowed payments under Medicare Part B FFS.[10] The public release and maturation of Medicare claims data has allowed for greater transparency in procedure and payment variation. In this context, we

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used FFS Medicare Part B claims data to examine geographic variation of intravitreal injection rates and Medicare payments per anti-VEGF injection among FFS Medicare beneficiaries 65 years of age and older across all 50 states and the District of Columbia in 2013.

Methods

Data Source

Medicare Provider Utilization and Payment Data 2013: Physician and Other Supplier Public Use Files (PUFs) were obtained from the CMS, the largest United States payer of FFS health care claims.[10] This publically available data set is based on CMS's National Claims History Standard Analytic Files, which has final action on FFS Medicare Part B claims and includes information on services and procedures provided to more than 27 million FFS Medicare beneficiaries (excluding Medicare disability) by more than 950 000 distinct health care providers in all states, territories, and the District of Columbia of the United States. The study did not require human subjects review and did not require institutional review board approval.

The Physician and Other Supplier PUF includes all claims for intravitreal injections and anti-VEGF agents at the national and state levels and contains information at the individual provider level indexed by the provider's National Provider Identifier and the specific services the provider furnished by using unique Healthcare Common Procedure Coding System/Place of Service billing codes. Available data include the number of services furnished, the average Medicare-allowed payment (including both expected Medicare and patient payments) for service and drug, the address and gender of the provider, and the number of unique FFS Medicare beneficiaries who received a given Current Procedural Terminology (CPT) code claim and treatment-specific J code from a specific provider. The Physician and Other Supplier PUF does not provide billing modifier code information and does not include information in cases where a provider furnished a specific CPT service to 10 or fewer Medicare beneficiaries. Further information detailing the content and limitation of the dataset can be found at http://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Medicare-Provider-Charge-Data/Downloads/Medicare-Physician-and-Other-Supplier-PUF-Methodology.pdf.

Intravitreal Injection and Anti–Vascular Endothelial Growth Factor Agents

By using the 2013 Medicare Physician and Other Supplier PUF, we identified all intravitreal injection claims (CPT code, 67028) of providers who administered more than 10 injections in the calendar year. This Medicare data set does not contain diagnostic code pairing, but by using the resources of Medassets CodeCorrect,[11] it is estimated that approximately 92% of CPT code 67028 was paired with exudative senile macular degeneration (International Classification of Diseases [ICD] code, 362.52) among FFS Medicare beneficiaries in 2013. The remaining 8% of CPT 67028 codes were paired primarily with vascular occlusion-related and diabetes mellitus–related ICD diagnosis codes.

We identified all anti-VEGF drug claims by using treatment-specific J code J0178 for aflibercept, J2788 for ranibizumab, and J9035, J3490, and J3590 for bevacizumab. Codes J3490 and J3590 are unclassified drug and biologic J codes. Code pairing estimates that 97% of J3590 codes were paired with exudative senile macular degeneration (ICD code, 362.52) and 3% with ICD codes 362.35, 362.36, 362.07, 362.02, and 362.01. Code J3490 was paired with only 1 ophthalmology-related code (362.52), suggesting nearly exclusive bevacizumab use.[11]

Data were aggregated and summarized by provider using the National Provider Identifier as a unique index. Total Medicare-allowed payments for each provider and each specific anti-VEGF drug were calculated by multiplying each provider's line service count by the average Medicare allowed payment for that specific provider independently for each CPT code and subsequently summing. Total FFS beneficiaries were determined by summing each provider's count of unique FFS beneficiaries who received service for each of the CPT codes. The geographic location of the anti-VEGF injection was attributed to the city of the ophthalmologist's address, regardless of the patient's state of residence. Medicare Advantage participants were not included by CMS in this FFS Medicare database, and consequently were not included in this analysis. A large number of Americans are enrolled in private Medicare Advantage plans and comprised 28% of all Medicare beneficiaries in 2013, with enrollment varying from less than 1% to 49% across all states.[12]

Anti-VEGF use also was assessed by region population density. Regions were divided into urban, rural, and very rural. An urban region was defined as a densely settled core of census tracts, census blocks, or both that met minimum population density requirements, along with adjacent territory containing nonresidential urban land uses as well as territory with low population density included to link outlying densely settled territory with the densely settled core. Rural and very rural regions were defined as the highest 75th percentile and lowest 25th percentile, respectively, of all areas not meeting the urban definition of population density.

Statistical Analysis

Data analyses were performed by using Microsoft Excel 2013 with PowerPivot, PowerQuery, PowerView, and PowerMap Preview plug-ins (Microsoft, Redmond, WA), and SAS software version 9.4 (Cary, NC). Overall comparisons were completed by using chi-square tests. Geographic variation was quantified by using the extremal quotient (EQ), coefficient of variation (CV), and systematic component of variation (SVC).[13] The EQ describes the largest relative difference by taking a ratio of the highest and lowest state injection rate or cost. The CV is the ratio of the standard deviation to the mean and shows the extent of variability to the mean. A CV of more than 1 represents high variance. The SCV most accurately reflects the true, nonrandom part of observed variation (i.e., beyond chance). An SCV of 3 to 5 equals moderate variation, 5.1 to 10 equals high variation, and more than 10 equals very high variation.[14] A high-level correlation was performed based on summary statistics in each state between the rate of intravitreal injections and anti-VEGF cost per injection and FFS beneficiaries. A simple Pearson correlation coefficient was used to examine relationships.

Results

Overall Volumes and Rates

The 2013 study population included 27 476 162 unique FFS Medicare beneficiaries 65 years of age and older in all 50 states and the District of Columbia of the United States. In 2013, Medicare either received a claim or a claim was submitted for 1 or more intravitreal injections for 539 660 (1.9%) of the 27 476 162 unique FFS beneficiaries. There were approximately 2 199 199 anti-VEGF drug claims submitted to Medicare in 2013. The total Medicare allowed payments for all anti-VEGF agents was $2 370 186 382, of