Medicare Part D payments for neurologist-prescribed drugs

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ABSTRACT

Objective: To describe neurologists' Medicare Part D prescribing patterns and the potential effect of generic substitutions and price negotiation, which is currently prohibited.

Methods: The 2013 Medicare Part D Prescriber Public Use and Summary files were used. Payments for medications were aggregated by provider and drug (brand or generic). Payment, proportion of generic claims or day's supply, and median payment per monthly supply of medication were calculated by physician specialty and drug. Savings from generic substitution were estimated for brand drugs with a generic available. Medicare prices were compared to drug prices negotiated by the federal government with pharmaceutical manufacturers for the Veterans Administration (VA).

Results: Neurologists comprised 13,060 (1.2%) providers with \$5.0 billion (4.8%) in total payments, third highest of all specialties, with a median monthly payment of \$141 (interquartile range \$85–225). Multiple sclerosis drugs had the highest payments (\$1.8 billion). Within neurologic disease groups (\$3.4 billion in payments), 54.2%–91.8% of monthly supplies were generic, but 11.9%–71.3% of the payment was for generic medications. Generic substitution resulted in a \$269 million (6.5%) payment decrease. VA pricing resulted in \$1.5 billion (44.5% of \$3.4 billion) in savings.

Conclusions: High payment per monthly supply of medication underlies the high total neurology drug payments and is driven by multiple sclerosis drugs. Lowering drug expenditures by Medicare should focus on drug prices. *Neurology*® 2016;86:1491–1498

GLOSSARY

AED = antiepileptic drug; **CMS** = Centers for Medicare & Medicaid Services; **IQR** = interquartile range; **MS** = multiple sclerosis; **NPI** = National Provider Identifier; **VA** = Veterans Administration.

Retail prescription drug spending was the third largest category of health care spending in the United States in 2013 (\$271 billion) behind hospital care (\$936.9 billion) and physician and clinical services (\$586.7 billion).¹ Medicare, which provides health insurance to over 52 million people ages 65 and over or those under 65 with permanent disability, spent \$103 billion alone for prescription drugs under the voluntary Part D program for the 68% (36 million people) of beneficiaries enrolled.^{2,3} Among physician specialties, neurologists have one of the highest total prescription and per claim costs despite a relatively small number of providers.³ Understanding neurologists' prescribing habits is a key step in identifying why neurologists are responsible for such a large portion of total and per claim Medicare Part D drug expenditures. Furthermore, identification of prescribing inefficiencies has the potential to inform future policy initiatives to improve the quality of care for Medicare beneficiaries and control health care costs.

Using comprehensive payment data available through the Centers for Medicare & Medicaid Services (CMS), the purpose of this study was to describe neurology prescribing patterns for Medicare Part D beneficiaries. Specifically, we aimed to determine which medications prescribed by neurologists account for the highest aggregate costs, investigate the difference in monthly costs between medications within different disease categories, and consider the

Supplemental data
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Go to Neurology.org for full disclosures. Funding information and disclosures deemed relevant by the authors, if any, are provided at the end of the article.

potential savings to Medicare through generic substitutions and direct price negotiation, which is currently prohibited.

METHODS We performed a retrospective, cross-sectional analysis of the 2013 Medicare Part D Prescriber Public Use File and 2 summary files.⁴ The Prescription Drug Event Standard Analytic File was used by CMS to create these files containing information on prescription drug events incurred by Medicare Part D (Medicare Advantage Prescription Drug plans and stand-alone Prescription Drug Plans) beneficiaries during the 2013 calendar year. The Public Use File contains prescription drug event information for each prescriber by National Provider Identifier (NPI), but excludes records derived from 10 or fewer claims, resulting in retained information for 86.8% of claims and 78.1% of total payments. The 2 summary files contain data aggregated by either NPI or drug name (drug filled); information is available on over 99.9% of total claims. Neither file contains beneficiary-level information or indication for the drug prescribed. Only drugs covered under the outpatient Part D benefit are included in the files; therefore, some physician-administered drugs (e.g., certain infusions) that are covered under Part B are excluded.

For each drug prescribed by a prescriber in the Public Use File, payment (medication cost, administrative and dispensing fees, sales tax), claim count (if > 10), day's supply, drug name, generic name, and specialty were available for analysis. Prescribers were considered neurologists if the specialty was designated as Neurology. We excluded 8,770 providers (1.1% of all providers) designated as Psychiatry & Neurology after review of top drugs by payment in the Public Use File indicating that most are psychiatrists. Drugs were designated as generic if the generic name matched the name recorded for the drug name variable. Rarely, the drug filled was generic, but a proprietary name was used (e.g., Epirol, Sellersville, PA, a generic preparation of carbamazepine); therefore, neurologist-prescribed drugs designated as brand were checked against the Food and Drug Administration database.

Because a claim does not represent a standard day's supply, drug volume prescribed was estimated by summing the day's supply for each drug and calculating the number of 30-day supplies (monthly supplies). The proportion of generic day's supply was calculated by summing the day's supply of generic medication and dividing by the total day's supply. Payments per monthly supply were generated by dividing the total cost by day's supply and multiplying by 30 for each drug, brand or generic. The authors divided neurologist-prescribed medications into disease-specific drug groups. Drugs that are often prescribed for multiple indications (e.g., topiramate for epilepsy or headache) were assigned to a single disease-specific group agreed upon by the authors (L.B.D., B.C.C.). Variables were summarized by drug group and specific drugs within each group. Similarly, the summary files were used to calculate total drug payments, payments by specialty, number of prescribers per specialty, number of monthly medication supplies per provider, proportion of generic claims per specialty, median payment per claim, and median payment per monthly medication supply.

To estimate the savings if all patients were prescribed generic rather than brand medications when available, all brand medications in the Public Use File were reclassified as generic (direct generic substitution) and payments for neurologist-prescribed drugs were recalculated as above. Similarly, the potential effect of direct price negotiation on Medicare Part D drug payments for disease-specific drug groups was estimated using Veterans Administration (VA) costs, because the VA is able to negotiate

medication prices directly, in contrast to Medicare (e-Methods on the *Neurology*[®] Web site at Neurology.org).⁵ Because doses are not available in the Public Use File, the lowest price was selected for each drug at each dose available and the mean negotiated price across all doses was calculated. If multiple vendors were available for the same drug at a specific dose, the lowest negotiated price was used. In the rare case that a different quantity of drug was negotiated for brand vs generic, the price per dose was calculated and negotiated price adjusted to reflect the same quantity prior to calculating the mean. Given nonstandard quantities of oral, IV solutions, and chewable preparations, these were excluded unless specifically identified in the Public Use File. For medications requiring titration to the effective dose (e.g., memantine), pricing for the final dose was used. All prices were from active contracts in 2013 except 19 drugs with contracts negotiated in 2014 or 2015; 12 drugs were not available through the VA (e-Methods).

We used the 2013 Physician and Other Supplier Public Use File to compare Medicare spending on outpatient pharmaceuticals to other commonly performed neurologic services.^{6,7}

Analyses were performed using Stata v13.1 (StataCorp, College Station, TX).

RESULTS The Medicare Part D summary file had 1,049,381 unique providers or facilities (e.g., skilled nursing facility, public health welfare agency); 13,060 were neurologists (1.2% of all providers or facilities), representing 99.3% of all neurologists actively practicing in the United States in 2013.⁸ The total Medicare Part D drug payment in the United States in 2013 was \$103.6 billion, with \$5.0 billion (4.8%) in neurologist-prescribed drugs; 75.7% of neurology drug claims were for generic medications (table 1). The median payment per neurologist claim was \$176 (interquartile range [IQR] \$102–\$286; range \$4–\$16,769) and the median payment per month of any neurologist prescribed medication was \$141 (IQR \$85–225; range \$4–\$17,882), fifth highest among specialties. Payment for neurologist-prescribed drugs was higher than all evaluation and management services or other commonly provided neurologic services in 2013 (table 2).

Because of redacted Public Use File data, the total number of unique providers, neurologists, total payments, payments for neurologist-prescribed drugs, median payment per claim, and monthly supply for neurologists were approximately 10%–20% lower than the summary file estimates. The total medication payment in the Public Use File attributable to neurologists for drugs prescribed for specific neurologic diseases (excluding “Other”) was \$3.4 billion compared to \$10.4 billion for the same medications when attributed to any provider (figure, table e-1). If direct generic substitutions occurred for all brand neurologist-prescribed medications, total payments for drugs prescribed by neurologists would decrease by \$269 million (6.5%). If VA pricing was substituted for Medicare payments for specific

Table 1 Total Medicare Part D payments by specialty type

Specialty	Total drug payment, \$, millions	No. providers	Median month's supply/provider ^a	Median payment/month of drug, \$	Proportion of claims, generic
Internal medicine	26,902	130,640	674	46	0.76
Family practice	22,374	106,048	2,826	41	0.78
Nurse practitioner	6,617	97,722	245	51	0.76
Neurology	4,984	13,060	1,235	141	0.76
Psychiatry	4,515	25,906	820	88	0.82
Cardiology	4,331	22,660	3,939	33	0.77
Hematology/oncology	3,757	7,844	696	512	0.79
Physician assistant	3,279	69,180	116	51	0.76
Pulmonary disease	2,397	8,882	967	159	0.47
Rheumatology	2,179	4,319	2,635	138	0.76
Endocrinology	2,059	5,261	2,737	99	0.48
Ophthalmology	1,970	19,616	846	71	0.29
Nephrology	1,968	7,871	2,083	83	0.73
Gastroenterology	1,765	12,690	727	130	0.67
General practice	1,725	11,135	771	40	0.77
Infectious disease	1,660	4,851	320	472	0.52
Specialty surgery	1,496	54,164	96	54	0.75
Medical oncology	1,081	2,735	556	474	0.80

^a Month's supply was calculated by summing the day's supply of drugs for each provider within a specialty group, then dividing by 30 to obtain the total number of monthly supplies per provider.

neurologic diseases (excluding "Other"), total payments for drugs prescribed by neurologists would decrease by \$1.5 billion (44.5% of \$3.4 billion), \$4.5 billion (43.4%) for the same medicines when attributed to any provider. The top 10 neurologist-prescribed drugs by payment are summarized in table 3 and the top 10 drugs by volume of drug prescribed are summarized in table e-2.

Multiple sclerosis (MS) drugs had the highest total payments for drugs prescribed by neurologists, accounting for \$1.8 billion (44.1% of total payments for drugs prescribed by neurologists); 82.4% of total payments for MS drugs are attributable to neurologists. None of the MS drugs was available as a generic and monthly payments for the 9 medications available in 2013 (table e-1) ranged from \$4,149 per month (teriflunomide) to \$5,072 per month (fingolimod). VA pricing substitution for MS drugs would result in a \$724 million (39.6%) decrease in payments for drugs prescribed by neurologists, \$887 million (40.0%) decrease in payments attributable to any provider.

Antiepileptic drugs (AEDs) were the second highest category of drug payments by neurologists, accounting for \$499 million (12.1% of total payments for drugs prescribed by neurologists; table 4). The proportion of this payment from generics was

33.6%, and the overall proportion of day's supply that was generic was 85.6%. The total payment for these medications when prescribed by any provider was \$1.1 billion. The median monthly payment for brand-only AEDs was \$567 (IQR \$279–\$1,472, range \$171–\$9,902). For AEDs with both brand and generics available, the median monthly brand payment was \$622 (IQR \$212–\$740, range \$38–\$1,065) and the median generic payment was \$41 (IQR \$31–\$66, range \$20–\$692). VA AED pricing substitution would result in a \$301 million (60.3%) decrease in payments for drugs prescribed by neurologists; \$713 million (63.2%) decrease in payments attributable to any provider.

Dementia medications were the third highest category of drug payments by neurologists, accounting for \$389 million (9.4% of total costs for drugs prescribed by neurologists; table 4). The proportion of this payment from generics was 11.9%, and the overall proportion of day's supply that was generic was 54.2%. Differing from MS drugs and AEDs, the payments for these medications were much higher for all prescribers (\$2.2 billion) than for neurologists alone. VA pricing substitution for dementia drugs would result in a \$153 million (39.2%) decrease in payments for drugs prescribed by neurologists, \$892 million (40.4%) decrease in payments attributable to any provider.

Table 2 Comparison of Medicare payments for drugs prescribed by neurologists to other services provided by neurologists in 2013^a

Service	Total payment, \$, millions ^b
Part D pharmaceuticals	4,139
E/M	939
EEG	147
Part B pharmaceuticals	138
EMG/NCS	135
Imaging	50
PSG	37
Injection/infusion	38
Other	24
IOM	8
Evoked potentials	7
Neurostimulation	6
Neuropsychiatric	6
Vestibular testing	6
Autonomic testing	3

Abbreviations: E/M = evaluation and management; IOM = intraoperative monitoring; NCS = nerve conduction study; PSG = polysomnogram.

^aThe number of neurologists in Medicare Part D = 13,060 vs 12,652 neurologists in Medicare Part B Physician and Other Supplier Public Use File.

^bTotal payments calculated from the 2013 Part D Public Use File and Part B Physician and Other Supplier Public Use File.

The fourth highest drug payment category was Parkinson disease (\$332 million, 8.0% of total payments for drugs prescribed by neurologists; table 4). The proportion of this payment from generic drugs was 56.1%, and the overall proportion of day's supply that was generic was 90.2%. VA pricing substitution would result in a \$151 million (45.5%) decrease in payments for drugs prescribed by neurologists, \$215 million (37.6%) decrease in payments attributable to any provider.

Neuropathic pain medications were the fifth highest drug payment category (\$215 million, 5.2% of total payments for drugs prescribed by neurologists; table 4). The proportion of this payment from generics was 24.8%, and the overall proportion of day's supply that was generic was 79.5%. VA pricing substitution for neuropathic pain medications would result in a \$83 million (38.7%) decrease in payments for drugs prescribed by neurologists, \$1.4 billion (38.4%) decrease in payments attributable to any provider.

DISCUSSION In 2013, Medicare Part D payments for drugs prescribed by neurologists were third

highest (\$5 billion) of any physician specialty. This finding is largely due to the high payment per monthly supply of medication, not because neurologists fail to prescribe generic medicines, which often have lower monthly payments. Nearly half of the payment for drugs prescribed by neurologists is from MS drugs, which have extremely high payments per month and no generics available. Yet, even when low-cost generics are available, payments for brand medications are so high that the total medication payment for drugs prescribed by neurologists at least doubles in most cases despite a low overall proportion of prescriptions for brand medications. Efforts to lower drug expenditures by Medicare should focus on drug prices.

To put neurology-related drug payments into context, Medicare paid nearly as much in 2013 for a single agent prescribed by neurologists, glatiramer acetate (\$820 million), as they paid for all of the evaluation and management performed by neurologists (\$939 million) in 2013 (table 2). When compared to the total evaluation and management payment and payments for diagnostic testing (MRI, EMG, EEG, CT, polysomnography, ultrasound, laboratory testing) ordered by the entire neurology workforce for any patient in 2010 (\$3.4 billion), not just Medicare beneficiaries, Medicare alone paid more for drugs prescribed by neurologists (\$5 billion).⁹ Yet neurologists prescribe as many generics as other outpatient providers.

This is perhaps most evident with MS drugs, where the high aggregate neurology payment is a reflection of the high payments per month of drug. MS drugs in the United States are extremely expensive, prices vary little, and costs have risen although more medications have entered the market.¹⁰ The same medications cost at least one-third less in other countries, such as the United Kingdom, Canada, and Australia, but unlike other countries and the VA system, Medicare is prohibited from directly negotiating drug prices under the Medicare Modernization Act.¹¹ Given the current pricing of MS drugs in the United States, neurologists have no cost-effective treatments.^{12,13}

One potential, though controversial, solution to high drug prices is to allow Medicare to directly negotiate with pharmaceutical companies. Currently, Medicare Part D plans are offered through private insurers in the form of stand-alone prescription drug plans or Medicare Advantage plans. None is offered by the federal government, although all plans must adhere to a standard minimum benefit and Medicare pays each plan a risk-adjusted capitation payment for each beneficiary. Plans vary widely in terms of formulary, drug tiers, and cost-sharing. If the redacted providers (those excluded from the Public Use File)

Figure Medicare Part D drug payments for neurologist-prescribed drugs by medication classification

See table e-1 for a comprehensive list of medications within each category.

prescribe medications similarly to nonredacted prescribers, we estimate nearly \$870 million in savings on MS drugs alone prescribed by neurologists (\$1.1 billion when prescribed by any provider) if Medicare, as a single entity, could negotiate drug prices and at least \$1.8 billion in savings when including drugs prescribed by neurologists (\$5.4 billion when prescribed by any provider) for other common neurologic diseases. Although the Congressional Budget Office

has stated that direct price negotiation would be unlikely to lead to substantial decrease in federal spending, except in cases where there is no direct (same active ingredient) or therapeutic generic substitute (same indication, different active ingredient), estimates using prices from the Medical Expenditure Panel Survey 2003–2004 projected \$21.9 billion in savings if Medicare could set prices at the same level as the VA Federal Supply Schedule.^{14,15} Furthermore, as the largest single payer in the United States, direct price negotiation by Medicare would undoubtedly influence prices negotiated by private payers as well. Similar policy solutions include using limited anti-trust waivers to allow Part D plans to negotiate as a group or extending Medicaid mandatory rebates to Medicare.¹⁶

Varying payments for medications based on the magnitude of their clinical benefit or added value (value-based drug pricing) may be another means of lowering Medicare drug expenditures. The high cost of many medications used to treat neurologic diseases is often in contrast to the small benefit these drugs provide. For example, memantine, which was responsible for \$245 million in neurology-related payments and \$1.5 billion in payments from any provider, has shown benefit only in those patients with moderate to severe dementia and the clinical effect is minimal at best.^{17,18} Even cholinesterase inhibitors (\$144 million), which are less expensive, demonstrate statistically significant, but clinically marginal improvements in cognitive measures with effects that wane over time.^{17,19} Value-based drug pricing would link drug prices to tangible quality measures, such as clinically significant improvement in cognition for dementia medications, rather than allowing pharmaceutical companies to set prices that maximize profits.

Another potential solution aimed at lowering spending on retail pharmaceuticals include limiting

Table 3 Medicare Part D top 10 neurologist-prescribed drugs by payments

Generic drug name	Payment attributable to neurologist, \$, millions	No. neurology prescribers	Months of supply	Proportion of all provider payments attributable to neurologists	Monthly payment, \$
Glatiramer acetate	820	3,996	173,748	0.82	4,720
Interferon- β -1a	358	3,386	79,502	0.81	4,502
Memantine	245	8,143	951,224	0.17	258
Interferon- β -1a-albumin	225	2,102	48,076	0.82	4,680
Fingolimod HCl	163	1,109	32,193	0.86	5,072
Immunoglobulin γ	161	614	11,302	0.71	14,247
Interferon- β -1b	118	1,195	26,198	0.79	4,513
Levetiracetam ^a	109	11,763	1,314,785	0.56	758 (brand), 41 (generic)

^a All medications were available as brand only except levetiracetam.

Table 4 Comparison of brand and generic payments for epilepsy, dementia, Parkinson disease, and neuropathic pain medications

Generic drug name	Payment attributable to neurologist, \$, millions	Months of supply	Proportion of all provider payments attributable to neurologists	Proportion of day's supply, generic	Monthly brand cost, \$	Monthly generic cost, \$
Epilepsy	499	4,949,095	0.44	0.86	—	—
Levetiracetam	109	1,314,785	0.56	0.94	758	41
Lacosamide	107	189,131	0.74	0	567	—
Lamotrigine	70	637,511	0.53	0.89	740	31
Divalproex sodium	43	482,728	0.15	0.91	346	66
Topiramate	40	791,659	0.46	0.96	742	23
Carbamazepine	35	473,871	0.47	0.80	157	52
Oxcarbazepine	18	229,551	0.39	0.94	554	49
Rufinamide	14	9,463	0.68	0	1,472	—
Phenytoin sodium extended	12	408,898	0.28	0.68	52	20
Felbamate	10	12,685	0.67	0.66	1,065	692
Zonisamide	10	171,867	0.67	0.96	623	36
Clobazam	9	19,881	0.78	0	475	—
Vigabatrin	8	849	0.84	0	9,902	—
Tiagabine HCl	3	4,689	0.34	0.33	727	597
Ezogabine	3	4,849	0.84	0	652	—
Phenobarbital	2	141,174	0.25	1.00	—	15
Valproic acid	1	18,332	0.14	0.96	733	38
Phenytoin	1	32,432	0.11	0.52	38	31
Ethosuximide	0.4	3,597	0.46	0.91	212	108
Methsuximide	0.1	868	0.50	0	171	—
Ethotoin	0.07	275	0.56	0	279	—
Dementia	389	2,779,194	0.18	0.54	—	—
Memantine HCl	245	951,224	0.17	0	258	—
Rivastigmine (transdermal)	86	285,424	0.22	0	303	—
Donepezil HCl	38	1,383,213	0.15	0.97	307	20
Galantamine HBr ^a	12	110,292	0.32	1.00	257	108
Rivastigmine Tartrate (oral)	8	49,040	0.22	0.99	347	158
Parkinson disease	332	3,313,862	0.58	0.90	—	—
Rasagiline mesylate	92	216,798	0.84	0	423	—
Carbidopa-levodopa ^a	67	1,757,416	0.57	1.00	209	38
Carbidopa-levodopa-entacapone	41	119,570	0.79	0.89	483	325
Ropinirole HCl	29	438,128	0.30	0.99	307	63
Entacapone	24	67,105	0.64	0.91	476	349
Pramipexole di-HCl	23	386,904	0.40	0.96	432	42
Amantadine HCl	17	195,282	0.56	1.00	—	89
Rotigotine	16	47,387	0.84	0	334	—
Apomorphine HCl	11	511	0.90	0	20,579	—
Carbidopa	6	12,184	0.75	0	463	—
Selegiline HCl	5	48,014	0.75	0.97	555	89
Tolcapone	2	1,080	0.59	0	1,616	—
Bromocriptine mesylate	0.3	1,162	0.05	1.00	—	268
Benzotropine mesylate	0.2	22,322	0.01	1.00	—	9

Continued

Table 4 Continued

Generic drug name	Payment attributable to neurologist, \$, millions	Months of supply	Proportion of all provider payments attributable to neurologists	Proportion of day's supply, generic	Monthly brand cost, \$	Monthly generic cost, \$
Neuropathic pain	215	3,015,867	0.06	0.79	—	—
Pregabalin	92	359,440	0.10	0	256	—
Duloxetine HCl ^b	67	250,248	0.04	0	267	205
Gabapentin	48	1,694,090	0.09	0.99	306	27
Venlafaxine HCl	3	88,378	0.02	0.99	258	32
Tramadol HCl ^a	2	133,076	0.02	1.00	327	15
Nortriptyline HCl ^a	2	181,687	0.15	1.00	724	10
Amitriptyline HCl	1	308,949	0.07	1.00	—	5

^a Brand preparation available, but quantity prescribed was negligible.

^b Generic preparation available, but quantity prescribed was negligible.

the use of brand drugs through federal policies that allow for direct and therapeutic generic substitutions.¹⁶ Even when generic medications are available and the majority of prescription drug volume is from generics, the cost of brand drugs is so high that in most neurologic diseases over half of the medication payment is for brand medicines. For example, drugs like topiramate, lamotrigine, and levetiracetam all have the same indication for partial epilepsy and all are available as generics with prices from \$20–40 per month compared to their brand alternatives, which are over \$700 per month. The result is that nearly 70% of the total payment for AEDs is from brand medications although 85% of the prescription volume is generic. The potential savings from limiting brand AEDs through mandatory direct therapeutic substitutions highlights the potential impact of this policy, but also underscores the need to definitively address the ongoing controversy regarding the possible superiority of brand over generic AEDs. Switching from brand to generic AEDs has been associated with an increase in epilepsy-related care.²⁰ Three ongoing, Food and Drug Administration–funded prospective trials will address this exact issue as well as switching between different generic options of the same medication.²¹

Similarly, the cost of lacosamide, rufinamide, clobazam, and ezogabine ranges from \$475 to \$1,472, but these drugs have no direct generic substitute available, although many generic options exist in different drug classes (therapeutic substitutes) costing between \$20 and \$40. These findings suggest that a significant reduction in Medicare expenditures may be possible through mandatory therapeutic substitutions or reserving newer, expensive medications for when several older medications have failed. Comparative effectiveness research is needed to clarify issues of treatment efficacy and tolerability, not only in epilepsy, but in other neurologic diseases as well to either

support or refute the use of specific brand medications over generics in different drug classes.

It is possible that lower Medicare expenditures could also be recognized without changes to federal policy by making medication costs, to both the patient and payer, more transparent at the time medications are prescribed. Physicians often are unaware of medication costs.²² Although there is little data on how price transparency may affect physician prescribing behaviors, price transparency studies involving laboratory testing have demonstrated savings, suggesting that it may be helpful in curbing pharmaceutical expenditures as well.^{23–26}

There are limitations to our study. The Public Use File is limited to Part D beneficiaries and data for which payments for more than 10 drug-specific prescriptions for individual providers were rendered. Though this excluded data results in underestimation of costs, it is unlikely to change the relative rank order of drugs and specialties. Furthermore, it is limited to medications covered by Part D and excludes medications covered only under the supplemental benefits of individual Part D plans. Additionally, prescribing patterns in the Public Use File might not be representative of how a prescriber treats non-Medicare patients. Without patient-level data, we cannot comment on the appropriateness of prescribed medications in individual patients.

Neurologists are responsible for the third highest Medicare Part D payments for retail pharmaceuticals. The reason for this is largely explained by the exceptionally high payments made for neurology-prescribed medications, particularly MS drugs. With little variation in MS drug price, neurologists are left with few alternatives to limit these costs. While multiple policy solutions will likely be necessary to limit Medicare Part D drug expenditures, one way to dramatically limit neurologist-prescribed drug payments would be to allow Medicare to directly negotiate prices similar to the VA and other countries.

AUTHOR CONTRIBUTIONS

Dr. De Lott made substantial contributions to the conception of the study, analysis and interpretation of the data, drafting and revision of the manuscript, and final approval of the manuscript. Dr. Burke made substantial contributions to the conception of the study, analysis and interpretation of the data, revision of the manuscript, and final approval of the manuscript. Dr. Kerber made substantial contributions to the conception of the study, interpretation of the data, revision of the manuscript, and final approval of the manuscript. Dr. Skolarus made substantial contributions to the conception of the study, interpretation of the data, revision of the manuscript, and final approval of the manuscript. Dr. Callaghan made substantial contributions to the conception of the study, analysis and interpretation of the data, drafting and revision of the manuscript, and final approval of the manuscript.

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