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How We Analyzed Doctors' Pharma Industry Ties and Medicare Prescribing

Companies spend more than a billion dollars annually to market their treatments, and a significant portion is targeted at doctors. We found that having an industry interaction for a given drug was correlated with higher prescribing volume for that drug.

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See a web presentation of this analysis here.
Data behind the analysis is available on the ProPublica data store and code is available on Github.

Overview

Pharmaceutical companies spend more than a billion dollars annually to market their treatments, and a significant portion is targeted at doctors. These interactions between doctors and pharmaceutical companies include sponsored meals, promotional speaking, consulting and travel expenses.

Financial interactions with pharmaceutical companies may cause doctors to write additional prescriptions that are not medically necessary, to substitute their prescribing toward less suitable drugs or to prescribe more expensive drugs over cheaper and equally appropriate options. It's also possible that, as drug manufacturers often argue, industry interactions improve doctors' behavior by giving them information on new treatments or more suitable options.

In 2014, the Centers for Medicare and Medicaid Services (CMS) publicly released data on industry payments to doctors for the first time under the Open Payments program. In 2016, ProPublica linked the Open Payments data with prescribing data from Medicare's prescription drug program, known as Part D, and found a relationship between the total dollar value of a doctor's interactions with drug and device companies and the overall percentage of brand-name drugs he or she prescribed.

Other research has found correlations between industry interactions and prescribing for certain classes of drugs, including opioids, urology drugs, oncology treatments, inflammatory bowel

disease treatments and heartburn medication. In one study, brand-name prescribing for certain classes of drugs was associated with receiving a single pharmaceutical industry sponsored meal. A study of prostate cancer treatments did not find evidence of a connection. A 2018 report by CareDash found that doctors who had an interaction with the makers of particular brand-name drugs prescribed that company's drug more than the generic alternative.

With this analysis, we show that this relationship is widespread on an individual drug level as well.

Our analysis found that for almost all of the 50 most-prescribed brand-name drugs in Medicare's prescription drug program in 2016, physicians who had an interaction with the manufacturer involving that drug prescribed the drug at higher rates than physicians who did not. We also found that among providers who had such interactions, the dollar value of those interactions was larger for physicians who prescribed the drug than for those who did not.

With the available observational data we are not able to say whether payments lead to prescribing that is counter to patients' interests, but our analysis provides new insight into the dynamics between doctors' industry interactions and their prescribing.

Methods

For this analysis, ProPublica used Medicare Part D data along with Open Payments data, both for the 2016 calendar year.

Medicare Part D data is provided by CMS as a publicly available download[1]. In 2016, Medicare Part D covered more than 41 million seniors and disabled people. A total of about 1.5 billion prescriptions were dispensed for about 3,000 drugs. More than a million providers prescribed under the program. Part D prescription data shows the number of claims for each drug by each provider in a given year. However, provider-drug combinations with fewer than 11 claims were redacted from the dataset.

Open Payments data is provided by CMS as a publicly available download[2]. Our analysis included only general payments, and it excluded research and ownership interests. We did not examine industry interactions related to medical devices in this analysis, though they are included in the Open Payments dataset. Open Payments covered almost $800 million in drug-related expenditures to more than 400,000 providers, related to about 1,800 different drugs in 2016. More than 400 different manufacturers disclosed payments in the dataset. For each payment, a company is required to list the name(s) of the covered product(s) involved, though in practice this did not always happen. Ninety-three percent of the payments reported included a specific product. Companies also can list more than one product related to each payment.

[1] This analysis uses Part D data downloaded July 2018.
[2] This analysis uses Open Payments data released by CMS on Jan. 17, 2018.

We limited our analysis to the 50 most-prescribed brand-name drugs in Medicare in 2016, by total number of claims, for which there was promotional spending. For a few highly prescribed brand-name drugs, companies did not meaningfully invest in promoting the drug to doctors in ways reflected in Open Payments. These drugs were not included in our analysis.[3]

The drugs in our analysis include many popular and expensive drugs. Our study included drugs important for treating diabetes, asthma, high cholesterol, hypertension and glaucoma. In 2016, each drug had at least 600,000 total claims, including refills. (The most prescribed brand-name drug, Lantus, had 8.6 million claims.) All together, these 50 drugs accounted for about 8% of all prescriptions under Part D.

Many of the drugs are expensive: 38 of the 50 drugs have yearly costs exceeding $1,000 per patient. As a sensitivity check, we also looked at the top 50 drugs in Medicare by total cost. There were 33 drugs that were in the top 50 when ranked by total claims and total cost.

<table 1: Drugs In Our Analysis>

Our analysis uses data from the 2016 calendar year. The prescription drug landscape has changed somewhat between 2016 and the publication of this analysis in 2019. Some drugs listed above have gone off patent, and competitors and generics have come to market.

<table 2: Medicare Claims and Cost>

In total, about $137 million appeared in Open Payments related to these 50 drugs, accounting for about 18% of all spending on drugs in Open Payments[4]. Some providers were paid thousands of dollars, often for promotional speaking. But the typical provider's experience was much more modest. Most providers only received meals, and for 49 of the 50 drugs, the median provider's yearly interactions were worth $100 or less per drug.

<table 3: Promotional Spending in Open Payments>

There is not a common physician identifier used in both datasets. Our method for matching provider identities across the files is the same as in our 2016 analysis, and it allowed us to match 99% of physicians in the 2016 Open Payments database to the corresponding physician data in the NPPES (National Plan and Provider Enumeration System) directory. The NPPES identifier is used in the Part D data.

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[3] Ten brand-name drugs were excluded from our 50 most-prescribed list because, while they had a high enough number of claims to be included, they had promotional payments worth less than $10,000 in the Open Payments data. One additional drug was excluded from the 50 most-prescribed list because there were fewer than 10 health care providers who both prescribed the drug and had an industry interaction in Open Payments. Two drugs were excluded from the 50 most-costly list because there were fewer than 10 health care providers who both prescribed the drug and had an industry interaction in Open Payments.

[4] Excludes payments to teaching hospitals and payments promoting medical devices.

The Open Payments data only covers medical professionals with MD, DO, DDS and DMD certifications. Part D data covers a broader group of medical professionals, including nurse practitioners, physician assistants, pharmacists and midwives. Because they are not covered by Open Payments reporting requirements, our analysis excluded such providers, based on the specialty reported by the provider in NPPES.

When looking at the correlation between prescribing and industry interactions, we were sensitive to the fact that the overall volume of a doctor's practice could influence our results. Similarly, we were aware that specialists might behave differently than generalist physicians. We used linear regression to control for doctors' total number of Part D claims and whether they were specialists. Separate linear regressions were run for each of the 50 drugs, using provider-level data.

We specified two different models to measure the relationship between industry interactions and prescribing. The first was specified as:

$$[\text{Part D claims for the drug}] = b_0 + b_1[\text{had an industry interaction about the drug}] + b_2[\text{generalist/specialist flag}] + b_3[\text{total Part D claims, all other drugs}] + e$$

We chose to use a binary measure for providers who did/did not have industry interaction instead of a measure of total dollar value of the interactions. Typically the value of industry interactions for a particular doctor and drug were quite small, and the most common type of interaction was sponsored meals. Prior medical and psychology literature has established that even small gifts influence behavior, and therefore we were most interested in capturing whether any interaction occurred, regardless of the value. Additionally, there were outliers whose interactions were worth thousands or tens of thousands of dollars. A binary measure of industry interaction avoided outlier issues.

Only providers with 11 or more claims for the drug were included in this model specification. Providers with fewer than 11 claims but who had industry interactions were excluded. This was necessary because we had no good comparison for such providers. Doctors with no industry interactions and who had fewer than 11 claims for a drug were not identifiable in our data.

This model controlled for practice volume using doctors' total Part D prescribing for all drugs other than the drug of interest. To avoid using a covariate that also measured the outcome variable, which was claims for the drug of interest, the covariate was defined as total Part D prescribing for all drugs minus prescribing for the drug of interest.

To supplement the model described above, we also specified a model that switched the predictor and response variables. The second model specification was also run as separate linear regressions for each of the 50 drugs. Again, provider-level data was used. The models were specified as:

$$[\text{total value of industry interactions about the drug (\$)}] = b_0 + b_1[\text{has 11+ claims for the drug}] + b_2[\text{generalist/specialist flag}] + b_3[\text{total Part D claims, all other drugs}] + e$$

Our first model focused on a hypothetical relationship where promotional payments influence doctors' prescribing. Another hypothesis for the causal pathway is that pharmaceutical companies target doctors for more promotional outreach based on existing prescribing behavior. This second model served to explore that hypothesis.

Only providers with at least $1 in industry interactions for the particular drug were included; providers with no industry interaction but who had 11 or more claims for the drug were excluded. This was necessary because we had no good comparison for such providers. Doctors with no industry interactions and who had fewer than 11 claims for a drug were not identifiable in our data. Another advantage of using both model specifications in our analysis was that it allowed us to look at both all providers who received a payment and all providers who wrote a prescription for the drug of interest, albeit in separate models.

This model also controlled for practice volume using doctors' total Part D prescribing for all other than the drug of interest. This was done to avoid having a covariate with a relationship to the independent variable — whether or not the doctor had 11 or more claims for the drug of interest.

For both models, p-values < 0.05 were considered statistically significant.

Findings

Industry payments to doctors were very common for the drugs in our analysis. For three drugs that are household names, it was more common for prescribers to receive a payment than not to. About 56% of prescribers[5] of Invokana, a diabetes medication, had an industry interaction related to the drug (including meals). For 32 of the 50 drugs, financial ties existed for at least 10% of doctors who prescribed that drug. Notably, in 2016, more than one in five doctors who prescribed[5] Oxycontin under Medicare had a promotional interaction with the drug's manufacturer, Purdue Pharma. On the low end, only 1% of prescribers[5] of Alphagan P, a glaucoma drug, interacted with the drug's manufacturer regarding that drug.

<table 4: Reach of Promotional Interactions>

We found that having an industry interaction focused on a given drug was correlated with higher prescribing volume for that drug. For 46 of the 50 drugs in our analysis, doctors who had an industry interaction specifically related to a drug prescribed more of the drug than those who did not. There was a positive, statistically significant difference in the number of claims written by doctors who had an industry interaction, compared with those who did not. We observed this

[5] Prescribers with with 11 or more claims for the drug under Medicare.

difference even when we limited the analysis to doctors who only received meals related to a particular drug.

For instance, for Breo, which treats asthma and COPD, providers who did not have an industry interaction related to the drug wrote, on average, about 30 prescriptions (including refills) for the drug. We estimated that having an interaction was correlated with an additional 10 claims for the drug, more than a 30% increase. On average across all 50 drugs, providers who received a payment specifically tied to a drug prescribed it 58% more than providers who did not receive a payment.

<table 5: Relationship Between Having Promotional Interactions and Prescribing Volume>

Additionally, among providers who had an industry interaction, manufacturers paid more to doctors who prescribed the drug at least 11 times, as compared with those who do not. For 35 of the 50 drugs in our analysis, we found that among doctors who had an industry interaction about the drug, there was a positive, statistically significant difference between the value of those interactions for doctors with 11 or more claims for the drug, compared with doctors with fewer than 11 claims.

Take providers who received a payment related to Amitiza, a laxative often used to treat irritable bowel syndrome. Providers with fewer than 11 claims had industry interactions related to the drug that were worth, on average, $50. Those who had 11 or more claims received, on average, an additional $100 in payments. As discussed above, most providers received payments totaling less than $100. But some significant outliers existed. Some providers, especially those who deliver promotional speeches for a drug, received payments worth thousands of dollars. It's possible that these outliers are influencing the results of this model.

<table 6: Relationship Between Prescribing and Value of Promotional Interactions>

Discussion and Limitations

Our analysis has identified a relationship between industry interactions and prescribing on an individual drug level. We cannot speak directly to causality. Industry interactions may influence which prescriptions a doctor chooses to write, either against or in line with patients' best interests. Or the causality could run in the other direction: a doctor's prescribing practices trigger the interactions. Drug companies often maintain that they identify physicians whose patients benefit from their drugs, and the types of promotional interactions reflected in Open Payments help them to share information about new therapies.

This analysis looked at prescribing and industry interactions in the same calendar year. Our work could be extended by looking at the correlation between industry interactions in one year and prescribing in subsequent years — for example, looking at the relationship between having

an interaction in 2015 and prescribing in 2016. Still, one year of data provides a valuable snapshot of prescribing behavior of very widely used drugs.

Our analysis looked at the relationship between a doctor having a promotional interaction of any value for a particular drug and the number of Medicare claims filed for that same drug. We chose to use a binary measure for providers who did/did not have industry interaction instead of a measure of total dollar value of the interactions because typically the value of industry interactions for a particular doctor and drug were quite small. Future research could look at dynamics around the value of payments and the characteristics of outlier doctors whose payments amount to thousands or tens of thousands of dollars.

The payments in Open Payments are reported to CMS by pharmaceutical companies, and they can be for meals or other interactions with very small monetary value. Some physicians are not even aware of industry interactions that appear in the dataset associated with their name. Some types of interactions are not logged in Open Payments, including samples provided to doctors.

This analysis only reflects prescriptions under Medicare Part D. For some physicians, only a small portion of their prescribing is under Part D. And prescribing under Part D skews toward an older patient population, though Medicare also covers disabled patients. Furthermore, the provider identified in the Part D prescribing data may not always be the medical decision-maker. For instance, in nursing homes, prescriptions written by specialists are sometimes submitted under the ID of the home's medical director.

Finally, our matching between providers is not perfect. For less than 1% of providers in Open Payments, we did not find a match on the NPPES directory.

This analysis builds on a growing body of research nearly unanimously pointing toward a relationship between doctors' industry interactions and their prescribing. Pharmaceutical companies have directly promoted their drugs to doctors for many years, spending more than a billion dollars annually. The companies seem to find a benefit from these interactions.

If these promotional interactions influence doctors' prescribing, they likely lead to patients shifting to more expensive drugs. These costs are borne by patients and by prescription drug plans, at very high volumes, as we have shown. Higher costs are often linked to lower patient compliance — skipping doses or not filling prescriptions. And while newer treatments are often more beneficial than the generics they replace, for some new treatments evidence of safety risks has emerged only after several years on the market, and after several years in which the treatment was promoted to physicians.

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Appendix: Data Decisions and Replicability

Linking drugs between the two datasets was not always a straightforward process, as drug names sometimes varied. Some drugs were collapsed under a single general name. For example, Breo, a drug to treat asthma and COPD, appeared in the Part D data as Breo Ellipta but appeared in the Open Payments data as both Breo and Breo Ellipta. Both variants were combined for our analysis.[6] For several insulin products, decisions about combining variants of the drugs were based on answers from the drug companies on how data was submitted to Open Payments. Novo Nordisk indicated that Novolog and Novolog Mix products were recorded separately in the data. Eli Lilly said that all variants of Humalog products were recorded in Open Payments under Humalog and similarly the Humulin family of products was all recorded under Humulin.

For about half of industry interactions promoting one of our top 50 drugs, more than one product was promoted. In about 15% of industry interactions, multiple top 50 drugs were promoted together. In any cases where multiple drugs were promoted during an interaction, we had no way to divide up the value of the interaction and therefore attributed the full amount to each drug listed. Care was taken not to double-count when combining variants of a single drug and when providing summary-level statistics.

This analysis used Open Payments data released by CMS on Jan. 17, 2018. After the data is published, companies have the opportunity to add, remove or change payments that appeared in past releases. Generally, these changes are minor relative to the overall number of payments, and that remained true for most of the 50 drugs in our analysis. However, for several drugs, data for payments made in 2016 changed appreciably in subsequent releases:

- For three drugs, Copaxone, ProAir and QVAR, nearly all payments in 2016 were removed in a subsequent data release. Payments for those three drugs appear for prior years and for 2017 and 2018. The manufacturer, Teva Pharmaceuticals, did not offer an explanation, despite multiple requests for comment.
- The drug name Premarin changed to Premarin Orals in a subsequent data release. Additionally, around 6,000 payments for Premarin Vaginal Cream were removed. The manufacturer, Pfizer, did not return messages to clarify.
- Nearly 400 promotional speaking payments related to Imbruvica were added in a subsequent data release.

Therefore, Open Payments data currently available for download on the CMS website will not exactly match the data used in this analysis.

[6] Of the 50 drugs in our analysis, 18 involved collapsing variants of the drug name. In the sensitivity analysis of 50 drugs with the highest total cost in Medicare, there were 15 drugs with multiple name variants.

Appendix: Table Notes

Table 1: Drugs In Our Analysis

A few additional drug name variations appear in later data releases, including ‘Premarin Orals’ and ‘Acthar.’

Table 2: Medicare Claims and Cost

Cost figures include costs incurred by Medicare, the Part D plan, the patient and any other applicable third party. They do not reflect any rebates.

Ranges provided for drugs that had multiple names on Part D data.

Table 3: Promotional Spending in Open Payments

Includes 'general payments' from the Open Payments data. Excludes research payments and ownership interests.

In Open Payments, this category is defined as: “Compensation for services other than consulting, including serving as faculty or as a speaker at a venue other than a continuing education program.”

Additional promotional speaking payments related to Imbruvica were added in a later data release. That data shows 57 recipients of promotional speaking payments and total spending of about $2,334,000.

Table 4: Reach of Promotional Interactions

Prescribers are those with 11 or more claims for the drug under Medicare.

Table 5: Relationship Between Having Promotional Interactions and Prescribing Volume

Stars indicate statistical significance at the following levels: *** 1%; ** 5%; * 10%.

An earlier table shows a higher number of providers with payments because in the earlier table, all providers in the Open Payments data are counted. This table only counts providers in our analysis, which excludes providers with fewer than 11 claims for the drug, providers such as nurse practitioners, and providers whose NPI could not be determined.

Table 6: Relationship Between Prescribing and Value of Promotional Interactions

Stars indicate statistical significance at the following levels: *** 1%; ** 5%; * 10%.

Doctors who had Rx are those who wrote 11 or more claims for the drug under Medicare. Doctors with no Rx had fewer than 11 claims.