HHS Public Access

Author manuscript

Mayo Clin Proc. Author manuscript; available in PMC 2022 April 16.

Published in final edited form as:

Mayo Clin Proc. 2022 February ; 97(2): 250–260. doi:10.1016/j.mayocp.2021.08.026.

Association between payments by pharmaceutical manufacturers and prescribing behavior in Rheumatology

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Abstract

Objective: To evaluate the association between pharmaceutical industry payments to rheumatologists and their prescribing behaviors.

Methods: Cross-sectional analysis of Medicare Part B Public Use File (PUF), Medicare Part D PUF, and Open Payments data for 2013–2015. Prescription drugs responsible for 80% of the total Medicare pharmaceutical expenditures in rheumatology were analyzed. We calculated the

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The rest of the authors report no conflict of interest.

An earlier version of this work was presented in the American College of Rheumatology Scientific Meeting of 2018.

mean annual drug cost per beneficiary per year, the percentage of rheumatologists who received payments, and the median annual payment per physician per drug per year. Industry payments were categorized as food/beverage and consulting/compensation. Multivariable regression models were used to assess associations between industry payments and both prescribing patterns and prescription drug expenditures.

Results: Out of 4,822 rheumatologists in the Medicare prescribing databases, 3,729 received any payment from a pharmaceutical company over this timeframe. Food/beverage payments were associated with an increased proportion of prescriptions for the related drugs (range 1.5–4.5%) and an increased proportion of annual Medicare spending for the related drugs (range 3–23%). For every $100 in food/beverage payments, the probability of prescribing increased (range 1.5–14% for most drugs) and Medicare reimbursements increased (range 6–44% for most drugs). Consulting/compensation payments were associated with an increased proportion of prescriptions (range 1.2–1.6%) and increased proportion of annual Medicare spending (range 1–2%). For every $1000 in consulting/compensation payments, both the probability of prescribing increased (5% or less for most drugs) and Medicare reimbursements increased (less than 10% for most drugs).

Conclusions: Payments to rheumatologists by pharmaceutical companies are associated with increased probability of prescribing and Medicare spending.

Keywords

Payments; industry; conflict of interest

Introduction

Prescription drugs are the third highest category of healthcare expenditures in the US, costing $328.6 billion in 2016.(1) Several of the most expensive drugs are used for the treatment of rheumatic diseases. (2, 3) Rheumatology, second only to oncology, has entered an era of rapid development of specialty drugs, including biological disease modifying antirheumatic drugs (DMARDs). Such agents are complex to manufacture, expensive to produce, and require expertise in handling.(4, 5) The majority of these drugs are under patent with no generic or approved “biosimilar” equivalent available. In the US context they are associated with high costs to patients and the healthcare system.(6)

With few head-to-head trials to guide treatment decisions, the decision to prescribe a drug may be influenced by factors other than their efficacy or safety, including monetary and non-monetary incentives from pharmaceutical companies.(7–9) Financial conflicts of interest were the most common practice-related ethical concern raised by rheumatologists in a survey of American College of Rheumatology members.(10) Prior studies have shown that physician-industry interactions, such as meeting with pharmaceutical representatives, accepting funds, or attending continuing medical education events sponsored by a pharmaceutical company, may lead to higher prescription rates of the sponsor’s drug.(7, 11–13) However, these studies did not include payments for office-administered medications, which generally have higher costs or included the range of medications and payments across a whole specialty of medicine with a well-defined physician population that prescribe most these drugs.

Rheumatologists constitute a small proportion of the physician workforce,(14) but have one of the highest costs per prescription drug claim among Medicare beneficiaries.(15) There are no data regarding the degree to which pharmaceutical industry payments are associated with rheumatologists' prescribing patterns. Such information could inform practice and policy for physicians, healthcare organizations, and regulatory agencies. It could also help patients interpret and utilize publicly reported data on industry payments to physicians and engage in informed shared decision making related to their disease management.

To address these key knowledge gaps, we systematically assessed associations between industry payments to rheumatologists and the prescribing of drugs responsible for most of the rheumatology-related Medicare expenditures.

Materials and Methods

We conducted a cross-sectional analysis of four publicly available datasets: Open Payments, Centers for Medicare and Medicaid Services (CMS) Physician Compare, Medicare Part B Provider Utilization and Payment Data: Physician and Other Supplier Public Use File (PUF), and Medicare part D PUF. Data available from each database between January 2013 and December 2015 were utilized, except for Open Payments which is available only after August 2013. The study used publicly available databases and was therefore deemed exempt by the Mayo Clinic Institutional Review Board. Patients and the public were not involved in this study.

Open Payments data contain payments by pharmaceutical and medical device industries to teaching hospitals and individual physicians.(16) Payments are categorized as general payments, research payments, or ownership. General payments include consulting fees, honoraria, gifts, entertainment, food and beverage, travel and lodging, education, charitable contributions (when requested by the physician), and non-research grants. Research and ownership payments were excluded, as these were concentrated among a small number of individuals and may represent a distinct causal association between payments and practice. Open Payments data do not include non-physician providers. Each payment record includes the associated medication or device and the recipient name. We used CMS Physician Compare to obtain information about practice size and locations, demographics, and training information for physicians who provide Medicare services.(17)

The Medicare Part B PUF contains information on specific services/procedures provided by the physician, including infusions or other office-based procedures, catalogued by Healthcare Common Procedure Coding System (HCPCS) code, submitted charges, and payments. The dataset also includes clinician information, including the national provider identifier (NPI), place of service, and provider type and specialty. Spending and utilization data in the Medicare part B PUF are aggregated by NPI, HCPCS code, and place of service.(18, 19) The Medicare Part D data include ambulatory drug prescription information from Medicare Advantage and stand-alone plans. Data are aggregated by year, prescriber NPI, and medication (generic and brand names) and include the total number of prescriptions (original prescriptions and refills), total drug cost, total 30-day standardized fill counts, and total day's supply. Neither PUF provides beneficiary level information, indications for the

prescription, or severity of disease.(18–20) Both PUFs censor records derived from ≤10 beneficiaries.

We identified rheumatologists based on prescriber specialty as recorded in the Medicare Part B and Part D PUFs. We calculated the average annual cost for each drug (paid by Medicare, beneficiaries or third parties) and arranged them in descending order. Drugs responsible for 80% of the total costs associated with rheumatology prescriptions were selected for analysis. Because prednisone is extensively used in inflammatory diseases, it was also included for comparison. The 12 medications responsible for 80% of rheumatologist-prescribed medication costs and prednisone are presented in Table 1.

All payments to physicians from the Open Payments database for these drugs were included. Because there was no common identifier between the Medicare datasets and CMS Open Payments data, the data were linked based on physician name with manual adjudication of duplicates. Payments were categorized into two categories: 1) “consulting and compensation,” intended for key opinion leaders, including speaker fees, consulting fees, honorariums, travel costs, and non-research grants; and 2) “food and beverage,” intended for physicians who receive information from key opinion leaders and from representatives of manufacturers, including food and beverages, gifts, or educational materials.

The percentage of rheumatologist prescribers who received pharmaceutical company payments, both overall and by type of payment, was calculated along with the median annual payment per physician per drug. The average annual cost per beneficiary was calculated by dividing the average annual cost by the number of beneficiaries among physicians with >10 beneficiaries per year.

As Medicare Part B and Part D PUF data are summarized per service unit rather than per claims (e.g. a regular dose of infliximab is 300 mg, since the service charge is done by 10 mg vials, this will have 30 service charges assigned to one beneficiary that day), the beneficiary day service count variable was used as a claim surrogate in the analysis to eliminate double-counting.

Statistical analysis

to assess the independent effects of payments have on the Medicare program, we estimated relative rates of prescribing and relative Medicare spending. For each rheumatologist, relative rates of prescribing one of the drugs were calculated as a percentage of that rheumatologist’s total number of Medicare claims of the drugs. Similarly, relative rates of annual Medicare spending associated with one of the drugs was calculated for each rheumatologist as a percentage of that rheumatologist’s total annual Medicare spending for years 2013–2015 for that drug.

We estimated two physician level multivariate models. These models had a dependent variable for each drug; for one model the outcomes were relative rates of prescribing and for the other model they were relative Medicare spending. Because most of the percentages of relative prescribing and spending for each drug were highly skewed, we log transformed

them. Independent variables were the percentages of consulting/compensation payments and food/beverage payments for each medication; these were calculated by dividing the payments of each type for a drug by the total payment of the same type received by the physician. Since these values (dollars) were very often 0, we categorized each into 0% vs > 0%.

To quantify the impact of payments based on the payment type and dollar amount, we estimated two additional models for each drug. First, to estimate the effects of payments on dollar amount on the probability of prescribing, we used logistic regression to examine the association between industry payments for a drug and any prescribing (yes or no) for that drug. Second, to estimate the association of payment amounts and Medicare expenditure, we used a log-normal model where the dependent variable was total drug reimbursements, and industry payments for the same drug was the independent variable.

At least 96% of the methotrexate, hydroxychloroquine and prednisone prescriptions were generic medications with no associated payments; therefore, these were excluded from the regression analysis. All models were adjusted for physician gender, practice group size, years since graduation from medical school and U.S. region.

Analyses were performed using Stata 16 and SAS V.9.4.

Results

We identified 4,822 rheumatologists who prescribed medications to Medicare beneficiaries, representing 86% of the estimated 5,595 rheumatologists in practice in the US in 2015. (21) Drugs with the highest number of prescribers and the least cost per beneficiary were prednisone, methotrexate and hydroxychloroquine. Their mean annual costs per beneficiary were $42, $358, and $362, respectively. Prednisone was also the least costly for Medicare overall ($16 million per year), despite being prescribed by the largest number of rheumatologists (n=4776). In contrast, repository corticotropin (rACTH) was the costliest per beneficiary ($230,000 per beneficiary per year) and prescribed by the fewest rheumatologists (n=156). The highest total mean annual expenditures were incurred by etanercept ($741 million), adalimumab ($620 million), and infliximab ($539 million). These drugs were both costly per beneficiary ($20,728 for etanercept, $21,492 for adalimumab, and $15,941 for infliximab) and were prescribed by many rheumatologists (4,068, 3,872, and 1,349, respectively). Overall, the mean annual cost per beneficiary for biologic agents ranged between $14,000 and $21,000, except for denosumab, which costs $1,270 per beneficiary per year.

Pharmaceutical industry payments to rheumatologists

The 12 medications accounting for 80% of total drug spending by rheumatologists were associated with 305,588 payments to 3,729 rheumatologists. Fewer than 2% of all prednisone and methotrexate prescriptions were brand name drugs (prednisone: Rayos; methotrexate: Otrexup, Trexall, Rasuvo and Rheumatrex), and 4% of the hydroxychloroquine prescriptions were brand name (Plaquenil). Only one third of prescribers of brand name methotrexate and prednisone received payments, with a median

payment of $9–10. There were no payments to rheumatologists from manufacturers of hydroxychloroquine. Hydroxychloroquine, prednisone, and methotrexate were excluded from subsequent analyses due to the very small proportion of associated industry payments.

The percentage of rheumatologists that prescribed a drug and received pharmaceutical company payments for that drug ranged from 46.5% to 96.2% (Table 2). Etanercept and teriparatide prescribers had the lowest percentage of prescribers with payments (46.5% and 50.4%, respectively), while rACTH prescribers had the highest (96%). Fewer than 10% of prescribers received consulting and compensation payments for most of the medications, except for adalimumab (10.7%), certolizumab (11.7%) and rACTH (32.7%). The highest median annual payments for food and beverage were rACTH ($133) and adalimumab ($98), however the mean annual payments for consulting and compensation were above $1000, with rACTH being the highest at $7160.

The largest proportion of claims by the average rheumatologist were for prednisone (32.4%), methotrexate (29.6%) and hydroxychloroquine(21.8%), while of the drugs associated with payments to physicians, the largest proportions were for etanercept (5.3%), adalimumab (4.0%), and infliximab (2.3%) (Table 3). For the average rheumatologist, 31.5% of the Medicare reimbursements were for etanercept, 25.2% for adalimumab and 9.1% for infliximab.

Association between receipt of pharmaceutical payments and relative rates of prescribing

In multivariate analyses, food and beverage payments for a drug were associated with increased prescriptions for that drug (Table 3, all $P < .05$). The increase in the proportion of claims for a drug when receiving food and beverage payments ranged from 1.5% for etanercept to 4.5% for infliximab. In the same model, any consulting and compensation payments except for denosumab were associated with increased prescriptions for the corresponding drug. The increase in the proportion of claims was in the range from 1.17 for etanercept to 2.1 for teriparatide.

Association between receipt of pharmaceutical payments and relative annual Medicare spending

Food and beverage payments for a drug were associated with increased relative Medicare spending on the corresponding drug (Table 3, all $P < .001$). The increase in the proportion of annual Medicare spending for most of the drugs was between 3–6%. The largest increases in the proportion of annual Medicare spending were observed for rACTH (23%) and infliximab (14%). In the case of consulting and compensation payments, all were associated with higher spending for the corresponding drug except for etanercept, infliximab, golimumab, abatacept and denosumab. For those associated with higher spending, the increase was less than 2%.

Association between receipt of pharmaceutical payments and probability of prescribing

In the additional models, food and beverage payments to rheumatologists were associated with an increased probability of prescribing the corresponding drugs (Table 4). For most drugs, every $100 in food and beverage payments was associated with between a

1.5% to 14% increase in the probability of prescribing. Substantially higher increases in the probability of prescribing were noted for denosumab (35%), infliximab (37%), and teriparatide (74%). Consulting and compensation payments were associated with increases in probability of prescribing except for etanercept, which had a high rate of prescription, both with and without receipt of pharmaceutical company funds.

Association of payment and Medicare reimbursement amounts

Food and beverage payments were associated with increased Medicare reimbursements amounts for all drugs except rituximab. The increases ranged from 6 to 44% for every $100 in food and beverage payments (Table 5); these increases were particularly pronounced for infliximab, and rACTH, whereby a payment of $100 to a prescriber of these drugs was associated with increases of approximately $72,000, and $30,000 in Medicare reimbursements, respectively. For most of the other drugs, for every $100 dollars in payments, the Medicare reimbursement increased by $8,000–13,000.

Consulting and compensation payments were associated with increased Medicare spending for all the drugs except Rituximab and Certolizumab. For every $1000 dollars on consulting and compensation payments, the increase in Medicare spending was around $3000. Similar to the food and beverage payments, infliximab and rACTH had higher increases than the rest of the drugs.

Discussion

In this national study of pharmaceutical company payments to rheumatologists, nearly half of all U.S. rheumatologists received some payment from a pharmaceutical company. Most payments to rheumatologists were for low dollar amounts. However, pharmaceutical company payments to rheumatologists were directly associated with the probability of the physician prescribing a drug marketed by that company, the proportion of prescriptions that are for that drug, and the resulting Medicare expenditures. These associations were strongest for food and beverage payments even though they were for low dollar amounts and not aimed at presumed key opinion leaders in the field.

Our study builds upon prior work demonstrating an association between pharmaceutical company payments and prescribing patterns by examining all the drugs prescribed by a medical specialty, estimating the effects of payments on Medicare claims and also annual Medicare spending, and by quantifying the effect of dollar amounts on both prescribing and Medicare spending. (11, 22) Large differences in the magnitudes of effect were observed between drugs. For instance, the probability of prescribing medications administered in the office, such as infliximab and denosumab, was disproportionately influenced by payments. Office-based medications may be influenced by financial considerations affecting both patients (i.e., lower out of pocket cost) and physicians (i.e., higher reimbursement by providing the infusion at their facilities), which may be driving this discrepancy.(23) Medications that are frequently deferred to other specialists, such as teriparatide and denosumab, were most strongly associated by food and beverage payments as compared to the other drugs. This may reflect greater awareness and comfort in using such drugs among

rheumatologists who participate in educational activities, which are frequently sponsored by the pharmaceutical industry.

While both types of payments were associated with greater probabilities of prescribing and higher Medicare reimbursements, every $100 in food and beverage payments (i.e., general items such as food and beverages, gifts, or educational materials) increased the probability of prescribing and Medicare reimbursements by more than 2-fold higher than every $1000 in consulting and compensation payments. This may reflect the fact that physicians who receive consulting and compensation payments often serve as opinion leaders and spend less time seeing patients or belong to a small group of clinicians who might have experience with the drug through clinical trials or early adoption, thus prescribing fewer drugs overall. In contrast, industry contacts with practicing clinicians and the associated food and beverage payments may raise awareness of novel therapeutics among prescribers with a high volume of patients. Prior work has also observed that even small payments, such as those related to meals, can have a large impact on prescribing behavior.(11, 24) However the impact of consulting and compensation payments may not be fully captured at the individual physician level. As Fleischman *et al* noted, when physicians receive consulting and compensation payments, the sponsored drug has a greater regional market share than when physicians receive food and beverage payments.(12) Overall, our study and similar work suggest that the current approach to regulating industry influence, which focuses on disclosure of large payments, may be inadequate.

Our findings regarding rACTH may be especially important for payers and policy makers. There is no high-quality evidence supporting the use of rACTH,(25) affordable alternatives are available (prednisone), and it was prescribed by only 156 of 4822 rheumatologists included in this study. Despite this, rACTH was responsible for 2.4% of rheumatology-linked Medicare costs during the study period. Nearly all the prescribers of rACTH received payments from its manufacturer, consistent with recent similar work.(23) A large proportion of these payments were for consulting and compensation, suggesting a focus on key opinion leaders.

The study has important limitations. First, data were suppressed for physicians who prescribed fewer than 11 claims in a given year. Exclusion of physicians who prescribed the drugs less frequently may have influenced the results. Second, because some rheumatologists may refer patients to infusion centers for these therapies, the Medicare part B claim may not be associated with the treating physician. The percentage of prescriptions for infusions following this billing pattern is unknown. Third, our study was limited to rheumatologists caring for patients with fee-for-service Medicare coverage, and the results may not be generalizable to other specialties or physicians caring for patients with private insurance. For example, Aetna, Cigna, and UnitedHealthcare have restricted reimbursement for rACTH in recent years, citing its lack of proven efficacy and the availability of more affordable options, and rACTH is not in the veteran affairs formulary, therefore an association between payments and prescribing in these setting are less likely.(25, 26) Fourth, our study did not control for the effect that payers' formularies may have on drug utilization and spending.(27) Finally, this study cannot provide causal relationships between the payments and prescribing patterns. Is possible that pharmaceutical industry

may focus on physicians who already prescribe their medications rather than inciting new prescribing. However, prior publications regarding opioid therapy prescriptions have shown that physicians who received payments were more likely to have greater opioid prescribing in the subsequent year.(28, 29) In addition, dose-response relationships between payments and prescribing have also been observed.(24)

Conclusion

Payments by the pharmaceutical industry to rheumatologists are common and are associated with prescribing patterns and increased Medicare expenditures. The growth of specialty pharmaceuticals is expected to continue and permeate other branches of medicine.(5) Our findings provide physicians, payers, patients, and policymakers with a broad picture regarding the potential impact of industry payments on specialists in fields with rapid development and expansion of indications of specialty drugs. Stakeholders need to be aware of these findings when prescribing, purchasing, utilizing specialty drugs or designing public policy.

Acknowledgments and affiliations

Financial support

Duarte-García is supported by CDC (U01 U01DP006491), the Rheumatology Research Foundation Scientist Development Award, the Robert D. and Patricia E. Kern Center for the Science of Health Care Delivery, the Women's Health Career Enhancement Award and the Eaton Family Career Development Award.

In the past 36 months, Dr. McCoy received research support through the National Institute of Diabetes and Digestive and Kidney Diseases (K23DK114497, R03DK114497, P30DK111024), AARP® Quality Measure Innovation Grant, and Mayo Clinic.

Dr Herrin receives funding from the Centers for Medicare and Medicaid Services to develop and evaluate provider performance measures.

Dr. Putman is supported in part by a Rheumatology Research Foundation Scientist Development award.

Dr. Ross currently receives research support through Yale University from Johnson and Johnson to develop methods of clinical trial data sharing, from the Medical Device Innovation Consortium as part of the National Evaluation System for Health Technology (NEST), from the Food and Drug Administration for the Yale-Mayo Clinic Center for Excellence in Regulatory Science and Innovation (CERSI) program (U01FD005938); from the Agency for Healthcare Research and Quality (R01HS022882), from the National Heart, Lung and Blood Institute of the National Institutes of Health (NIH) (R01HS025164, R01HL144644), and from the Laura and John Arnold Foundation to establish the Good Pharma Scorecard at Bioethics International.

In the past 36 months, Dr. Shah has received research support through Mayo Clinic from the Food and Drug Administration to establish Yale-Mayo Clinic Center for Excellence in Regulatory Science and Innovation (CERSI) program (U01FD005938); the Centers of Medicare and Medicaid Innovation under the Transforming Clinical Practice Initiative (TCPI); the Agency for Healthcare Research and Quality (1U19HS024075; R01HS025164; R01HS025402; R03HS025517); the National Heart, Lung and Blood Institute of the National Institutes of Health (NIH) (R56HL130496; R01HL131535); the National Science Foundation; and the Patient Centered Outcomes Research Institute (PCORI) to develop a Clinical Data Research Network (LHSNet).

Conflicts of interest disclosure

Dr. Matteson has served in Advisory Boards of Boehringer Ingelheim (>$10,000), Gilead Sciences (>$10,000); Speakers Bureau Simply Speaking (> 10,000), Boehringer-Ingelheim. (<$10,000) and received royalties from UpToDate (>$10,000)

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Table 1.

Drugs responsible for 80% of the costs related to rheumatology prescriptions. Drugs are listed in descending mean annual cost per beneficiary in US dollars.

Medication	% of costs	Total Number of Rheumatologist Prescribers	Mean Annual Medication Cost, $	Mean Annual Cost per Beneficiary, $[1]
rACTH	2.4	156	81,819,665	229,955
Adalimumab	18.1	3872	619,979,397	21,492
Etanercept	21.7	4068	740,776,562	20,728
Infliximab	15.8	1349	539,084,516	15,941
Golimumab	1.9	1124	66,218,740	15,476
Rituximab	1.8	490	108,285,621	15,173
Certolizumab	2.7	1051	91,209,539	13,941
Abatacept	6.8	1936	224,659,322	13,445
Teriparatide	1.9	1596	65,124,565	9,379
Denosumab	2.0	1671	69,004,446	1,268
HCQ	2.4	4664	82,781,282	362
Methotrexate	3.0	4721	103,695,961	358
Prednisone	0.5	4776	15,717,827	42

[1] Defined as total drug cost divided by number of beneficiaries for the subset with available beneficiary counts (i.e., physicians with >10 beneficiaries per year)

rACTH, Repository corticotropin; HCQ, hydroxychloroquine

Table 2.

Payments by pharmaceutical companies to rheumatologists by prescribed medication.

Medication[2]	% with any Sunshine payment	% with consulting and compensation payment[1]	% with payment food and beverage[1]	Per-Physician Median (IQR) Annual Payments, $	Per-Physician Median (IQR) Annual consulting and compensation Payments, $	Per-Physician Median (IQR) Annual food and beverage Payments, $
rACTH	96.2	32.7	96.2	139 (68 – 2,367)	7,160 (2,027 – 21,451)	136 (68 – 272)
Adalimumab	56.6	10.7	56.4	111 (33 – 265)	2,796 (1,138 – 5,981)	98 (31 – 202)
Etanercept	46.5	3.6	46.4	78 (27–148)	2,045 (501 – 5,223)	73 (26 −140)
Infliximab	64.0	7.2	64.0	31 (12 – 70)	1,322 (1,175 – 1,662)	30 (12 – 66)
Golimumab	68.5	9.1	68.5	79 (29 – 185)	1,382 (1,097 – 4,861)	75 (29 – 160)
Rituximab	74.3	5.9	74.3	99 (34 – 179)	3,252 (854 – 7,466)	95 (34 – 171)
Certolizumab	70.6	11.7	70.2	79 (35 −175)	1,334 (24 – 3,939)	78 (34 – 161)
Abatacept	59.8	3.7	59.8	57 (22 −122)	4,974 (1,830 −9,773)	57 (21 – 117)
Teriparatide	50.4	2.6	50.3	18 (9 – 40)	1,259 (683 – 2,288)	18 (8 – 38)
Denosumab	63.3	1.0	63.3	60 (24 – 109)	4,645 (985 – 6,271)	60 (24 −109)

[1] Consulting and compensation=Speaker fees, consulting fees, honorariums, travel costs and grants; type2=food and beverages, gifts, education, entertainment

[2] There were no payments associated with hydroxychloroquine. Methotrexate and prednisone were excluded since more than 96% of the prescriptions were generic with no payment association.

rACTH, Repository corticotropin

Table 3.

Proportion of claims and medication annual Medicare reimbursement per physician and changes on claims and Medicare Reimbursement among those receiving industry payments adjusted for physician gender, practice group size, years since graduation from medical school and U.S. region

Drug name	Per-physician proportion of Claims, % Mean (SD)	Per-physician proportion of annual Medicare spending, % Mean (SD)	Increase in % claims when receiving consulting / compensation payments	Increase in % claims when receiving food / beverage payments[#]	Increase in % of annual Medicare spending when receiving consulting / compensation payments	Increase in % of annual Medicare spending when receiving food / beverage payments[#]
rACTH	0.04 (0.3)	1.1 (7.4)	1.57[#]	1.64	1.87[#]	23.13
Adalimumab	4.0 (4.7)	25.2 (21.3)	1.19[#]	1.80	1.19[&]	3.69
Etanercept	5.3 (5.7)	31.5 (23.7)	1.17[&]	1.54	1.11	2.53
Infliximab	2.3 (5.3)	9.1 (17.6)	1.20[&]	4.48	1.20	13.74
Golimumab	0.3 (1.1)	1.7 (5.1)	1.20[#]	1.93	1.09	5.32
Rituximab	0.4 (1.5)	1.2 (4.6)	1.25[#]	3.29	1.21[&]	9.08
Certolizumab	0.5 (1.9)	2.0 (6.2)	1.30[#]	2.40	1.29[#]	6.69
Abatacept	1.4 (3.0)	4.8 (9.1)	1.27[#]	2.49	1.13	6.03
Teriparatide	0.8 (2.6)	2.6 (7.5)	2.13[#]	2.29	2.10[#]	4.45
Denosumab	1.4 (3.5)	2.1 (5.9)	1.22	2.94	1.19	4.04
HCQ	21.8 (11.2)	8.0 (14.0)	--	--	--	--
Methotrexate	29.6 (10.5)	8.6 (12.9)	--	--	--	--
Prednisone	32.4 (13.4)	2.5 (9.5)	--	--	--	--

rACTH, Repository corticotropin; HCQ, hydroxychloroquine

[#]p<0.0001

[&]p<0.05

Table 4.

Association between prescribing and industry payments adjusted for gender, practice group size, years since graduation and region

Drug name[1]	Probability of prescribing without payments, %	Increase in probability of prescribing per $1000 in consulting / compensation payments, %[2]	Odds ratio per $1000 consulting / compensation payments (95%CI)[2]	Increase in probability of prescribing per $100 in food / beverage payments, %[2]	Odds ratio per $100 food / beverage payments (95%CI)[2]
rACTH	1.8	0.4	1.24 (1.18, 1.31)	1.4	2.10 (1.84, 2.41)
Adalimumab	78.3	5.9	1.48 (1.27, 1.72)	11.0	1.97 (1.75, 2.22)
Etanercept	83.4	1.3	1.10 (0.97, 1.25)	11.3	2.57 (2.10, 3.14)
Infliximab	20.8	21.5	2.80 (2.01, 3.89)	37.1	5.69 (4.40, 7.36)
Golimumab	20.4	1.5	1.09 (1.05, 1.14)	6.7	1.50 (1.39, 1.62)
Rituximab	6.3	1.3	1.23 (1.11, 1.36)	6.7	2.69 (2.33, 3.10)
Certolizumab	19.1	2.9	1.20 (1.11, 1.29)	4.9	1.36 (1.25, 1.47)
Abatacept	38.3	1.2	1.05 (1.01, 1.10)	13.7	1.77 (1.58, 1.98)
Teriparatide	31.1	59.3	20.9 (3.58, 121.9)	74.5	382.9 (196.0,747.9)
Denosumab	30.7	5.0	1.26 (1.02, 1.55)	34.9	4.54 (3.81, 5.40)

[1]There were no payments associated with hydroxychloroquine. Methotrexate and prednisone were excluded since more than 96% of the prescriptions were generic with no payment association.

[2]Consulting and compensation=Speaker fees, consulting fees, honorariums, travel costs and grants; type2=food and beverages, gifts, education, entertainment

rACTH, Repository corticotropin

Table 5.

Association between total annual drug cost among prescribers and industry payments adjusted for gender, practice group size, years since graduation and region.

Drug name[1]	Mean annual cost of prescriptions by rheumatologists w/o payments, $	Multiplier per $1000 consulting / compensation payments (95%CI)[2]	Increase in Medicare spending per $1000 in consulting / compensation payments (95%CI), $[2]	Multiplier per $100 food / beverage payments (95%CI)[2]	Increase in Medicare spending per $100 in food / beverage payments, $[2]
rACTH	375,881	1.02 (1.01, 1.03)	8,424	1.09 (1.05, 1.13)	30,205
Adalimumab	151,219	1.01 (1.00, 1.02)	1,580	1.06 (1.04, 1.08)	8,231
Etanercept	171,088	1.02 (1.00, 1.04)	3,679	1.11 (1.07, 1.15)	17,728
Infliximab	367,952	1.14 (1.09, 1.20)	52,084	1.20 (1.09, 1.33)	72,421
Golimumab	53,316	1.05 (1.04, 1.06)	2,847	1.23 (1.18, 1.28)	9,805
Rituximab	204,643	1.03 (0.96, 1.11)	6,189	1.10 (0.93, 1.29)	18,223
Certolizumab	77,474	1.04 (0.98, 1.10)	3,137	1.11 (1.03, 1.20)	7,733
Abatacept	101,893	1.03 (1.00, 1.06)	3,095	1.13 (1.07, 1.19)	12,399
Teriparatide	39,544	1.11 (1.03, 1.19)	4,172	1.29 (1.08, 1.55)	11,237
Denosumab	36,733	1.14 (1.12, 1.16)	5,156	1.44 (1.37, 1.52)	13,443

[1] There were no payments associated with hydroxychloroquine. Methotrexate and prednisone were excluded since more than 96% of the prescriptions were generic with no payment association.

[2] Consulting and compensation = Speaker fees, consulting fees, honorariums, travel costs and grants; food and beverage=food and beverages, gifts, education, entertainment

rACTH, Repository corticotropin