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Are Financial Payments from the Pharmaceutical Industry Associated with Physician Prescribing? A Systematic Review

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Abstract

Background: Financial payments from the drug industry to US physicians are common. Payments may influence physicians' clinical decision-making and drug prescribing.

Purpose: To evaluate whether receipt of payments from the drug industry is associated with physician prescribing practices.

Data Sources: We searched Medline (Ovid), Embase, the Cochrane Library, Web of Science, and EconLit without language restrictions. The search had no limiting start date and concluded on September 16, 2020.

Study Selection: We included studies that estimated the association between receipt of industry payments (exposure) and prescribing (outcome).

Data Extraction: Pairs of reviewers extracted the primary analysis or analyses from each study and evaluated risk of bias.

Data Synthesis: 36 studies comprising 101 analyses were included. The majority of studies (30) identified a positive association between payments and prescribing in all analyses; the remainder (6) had a mix of positive and null findings; no study had only null findings. 89 of 101 individual analyses identified a positive association. Payments were associated with increased prescribing of the paying company's drug, prescribing costs, and increased prescribing of branded drugs. 9 studies assessed and found evidence of a temporal association; 25 studies assessed and found evidence of a dose-response relationship.

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Limitations: Observational design; 21 of 36 studies had serious ROB; potential publication bias.

Conclusions: The association between industry payments and physician prescribing was consistent across all studies that have evaluated this association. Findings regarding a temporal association and dose-response suggest a causal relationship.

Introduction

Personal financial payments to physicians are a common marketing strategy used by the pharmaceutical industry. These payments include both cash (typically for consulting services or invited lectures) and in-kind gifts such as meals. From 2015-2017, 67% of all US physicians received payments (1). This proportion exceeded 80% in many specialties (medical oncology, orthopedic surgery, urology, and others), and in many specialties the dollar value of personal payments has increased in recent years (2–5). The value of industry payments to US physicians is substantial, totaling $2.18 billion in 2018 alone (6,7).

Concern has been raised that industry payments may result in the inappropriate influence of commercial interests on medical practice (8,9). A small portion of physicians receive payments substantial enough to constitute the majority of their income (3,10–12). Smaller payments are more common, but even small payments may influence physician behavior by triggering a sense of mutual obligation, or *reciprocity,* to persuade physicians to increase prescribing (15,16).

Previous work has found an association between physician prescribing and contact with the drug industry. Physicians who receive industry information on pharmaceutical products, direct contact with industry salespersons (“detailing”), or free drug samples increase their prescribing of the paying company’s drugs (17–21). However, these types of interactions frequently also involve financial payments to physicians, and until recently the opacity of these payments limited investigation into their relative importance as a component of industry marketing.

Beginning in 2013, the Open Payments reporting system created by the “Sunshine Act” has made public all financial transfers greater than $10 in value from drug and device manufacturers to US physicians and several other provider groups including chiropractors and dentists. Open Payments has enabled large-scale, quantitative investigation into the *financial* component of physician-industry interactions. Since then, numerous studies have used Open Payments data to assess whether industry payments influence physician prescribing. Given the rapid, recent emergence of the literature on industry payments, the totality of this body of work has not yet been examined.

These recent studies have assessed industry payments across a broad range of medical specialties and drug classes, with heterogeneous results. As a result, there has not been consensus on the overall association of industry payments with physician prescribing, or whether such an association is causal. Therefore, we conducted a systematic review of the association between industry payments and physician prescribing. The goal of this review was to understand: 1) the association between payments and prescribing across the spectrum

of medical practice, and 2) whether there is sufficient evidence to conclude that payments cause physicians to change prescribing.

Methods

The review protocol was submitted to PROSPERO on September 20, 2019 but was not eligible for registration in accordance with PROSPERO policies to include only studies of direct measures of human health. The submitted protocol is available in the Appendix.

Data Source and Searches

Our search included 5 databases: Medline (Ovid), Embase.com, the Cochrane Library (Wiley), Web of Science Core Collection (Clarivate), and EconLit (EBSCO). The search strategy was designed in Medline and translated to the remaining databases. It combined two main concepts, represented with keywords and subject headers, linked using the AND operator: prescribing (*e.g., prescriptions, practice patterns, inappropriate prescribing*) and pharmaceutical relationships (*e.g., conflict of interest, Sunshine Act, Open Payments*). In Medline and Embase, the Cochrane Handbook filter was used to exclude animal-only studies (22). A second librarian performed a Peer Review of Electronic Search Strategies (PRESS) review of the search (23). We did not apply language restrictions or a beginning date cutoff. Duplicates studies were removed using the Bramer method (24). Databases were searched on September 23, 2019, with an update on September 16, 2020. Separately, on September 16, 2020 we searched MEDLINE to identify previously published reviews on this topic. We used the database Scopus to compile references cited by the included studies to identify additional relevant studies. See the Appendix for the full search strategy.

Study Selection

After deduplication, search results were imported into a reference management tool (Covidence, Veritas Health Innovation Ltd). Titles and abstracts were screened independently by 2 reviewers (A.M., N.T., S.C., S.T., or D.K.). Disagreements were resolved through group consensus. All studies deemed eligible during screening underwent full-text review by 2 reviewers independently (A.M., N.T., S.C., S.T., or D.K). Disagreements were resolved through group consensus. Studies were eligible for inclusion if they (1) had full text available, (2) were empirical, peer-reviewed experimental or observational studies (e.g. excluding guidelines, opinion pieces, and reviews), (3) focused on physicians (although other independent clinical practitioners could be included, as well), (4) studied financial payments from pharmaceutical companies as an exposure, and (5) studied prescribing of pharmaceutical products as an outcome.

Data Extraction and Quality Assessment

We used a standardized template to extract study characteristics, analytic design (eg., independent and dependent variables, statistical tests applied), results, and risk of bias (additional details below). Data were independently extracted from eligible studies by one reviewer (A.M., N.T., S.C., S.T., D.K. or R.G.) and checked for accuracy by a second reviewer, with any disagreements resolved through group consensus.

Risk of Bias Assessment

We applied the Risk of Bias in Non-Randomized Studies of Interventions (ROBINS-I) tool to assess risk of bias (ROB) (25). With ROBINS-I, each analysis is assessed for ROB on several individual domains, and then assigned an overall ROB that must be at least as high as the highest-risk individual domain. The possible levels of ROB in ROBINS-I are: unclear, low, moderate, serious, and critical. Because none of the included studies compared prospective interventions, the ROBINS-I domain of *risk of bias due to deviations from intended interventions* was not applicable and was omitted. Because some studies comprised multiple analyses which used different methods, ROB was assessed for each analysis separately. Analyses assessed as having critical ROB were determined not to make meaningful contributions to the overall assessment of the payment-prescribing association and therefore were excluded from the evidence synthesis.

Data Synthesis and Analysis

For each study, we abstracted results of the primary analysis. In cases where studies had performed several different analyses to address the same underlying question, we selected the outcome that was the broadest (in cases where both overall and subgroup results were presented), used continuous measures of industry payments and prescribing (vs. binary or categorical measures), and measured the prescribing of drugs manufactured by the specific company making payments (vs. measured prescribing of multiple drugs). We selected results that accounted for physicians' overall prescribing volume or prescribing volume within the same drug class (vs. those that measured prescribing of the drug[s] of interest without accounting for prescribing volume of other drugs), and results that adjusted for physician characteristics including gender, specialty, and others (vs. unadjusted analyses) when available. In cases where industry payments were measured on a categorical scale, we chose the analysis with the greatest contrast (e.g., $1,000 vs. $0 was preferred over $100 vs. $0). In cases where the study presented several co-equal primary analyses, we abstracted all of them.

The analytic approaches and characteristics of included studies were sufficiently heterogeneous that quantitative meta-analysis was not feasible. We therefore performed a qualitative synthesis of the results.

For each analysis, we assessed whether the association between payments and prescribing was *positive* (industry payments had a statistically significant association with increased prescribing), *inverse* (industry payments had a statistically significant association with reduced prescribing), or *null* (no statistically significant association). For each study, we assessed whether all constituent analyses identified a positive association between payments and prescribing: *yes* (all analyses had a positive association), *no* (all analyses had either a null or inverse association), or *mixed* (some analyses had a positive association, while some were null or inverse). We also characterized whether each analysis assessed temporal or dose-response relationships between payments and prescribing.

This review conforms to the Meta-analysis of Observational Studies in Epidemiology reporting guidelines. This was supported by the NCI MSK Cancer Center Support Grant, P30 CA008748.

Results

Figure 1 provides details on study selection in accordance with Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). A total of 3,460 unique studies were identified in database searches. Of these, 103 were accepted for full-text review, of which 37 were eligible for inclusion. The list of 66 excluded studies and reasons for exclusion are provided in Appendix Table 1. Review of references of included studies did not identify any new studies eligible for inclusion.

Risk of Bias

The primary analyses for 15 of the 37 studies had moderate ROB, 21 studies had serious ROB, and one study had critical ROB and was excluded (26) (Appendix Figure 1). This left 36 studies for inclusion in the evidence synthesis. For one study, some analyses had serious ROB and others had critical ROB; the analyses with critical ROB were excluded (27). All studies had at least moderate ROB due to confounding, as the ROBINS-I tool specifies that low ROB due to confounding is typically achieved only in prospective, randomized trials. We determined that any study using Open Payments data to measure industry payment would have at least moderate ROB due to classification of interventions, because of concerns that Open Payments data contain inaccuracies (28,29); this was the primary reason that 33 studies had at least moderate risk of bias in this domain. Studies commonly had low ROB due to missing data (35 studies) and measurement of outcomes (26 studies), resulting from use of broad government datasets to measure physician characteristics and prescribing behavior.

Study Characteristics

Characteristics of the included studies are summarized in Table 1 (individual study characteristics are in Appendix Table 2). The majority of studies (35) were published in 2016 or later. Medicare data was the most commonly used source to measure physician prescribing (34 studies), and Open Payments was used most commonly (32 studies) to measure industry payments. All studies but 1 were US-based, and most (32) were nationwide, while the remainder (3) focused on smaller regions.

11 studies analyzed multiple drug classes. Studies analyzing specific drug classes focused on opioids (7 studies), antineoplastics (3 studies), anti-VEGF agents (3 studies), and (1 study each) biologics for inflammatory bowel disease, erectile dysfunction drugs, gabapentinoids, intranasal corticosteroids, multiple sclerosis drugs, alpha blockers and overactive bladder drugs, proton pump inhibitors, statins, tumor necrosis factor inhibitors, anticoagulants, antipsychotics, and NMDA receptor antagonists.

22 studies analyzed all physicians in aggregate. Specialties that were analyzed separately within one or more studies (some studies analyzed multiple specialties) included: primary care (5 studies), hematology-oncology (5), urology (4), neurology (3), ophthalmology (3),

cardiology (2), gastroenterology (2), nephrology (2), psychiatry (2), rheumatology (2), and (1 study each) chiropractic, dentistry, dermatology, endocrinology, general surgery, optometry, otolaryngology.

Payment-prescribing associations

Of the 36 studies, 30 found only positive associations between industry payments and prescribing in all constituent analyses (Figure 2A, Appendix Table 3). 6 studies had mixed results, reporting one or more positive associations and one or more null associations among their analyses; no study reported only null results. By ROB, 11 of 15 studies with moderate ROB and 19 of 21 studies with serious ROB identified a positive association in all analyses.

The 36 studies contained 101 individual analyses. 89 of the 101 analyses (88%) identified a positive association between industry payments and prescribing; 12 analyses were null, and none identified an inverse association (Figure 2B). Of the 12 null analyses, 5 had moderate ROB and 7 had serious ROB.

Types of payments

Studies reporting on the distribution of industry payments consistently found that food and beverage payments were the most common, and payments for compensation, honoraria, and consulting were less common but of greater dollar value (30–33). Regarding the association of different payment types with physician prescribing, 30 studies analyzed all personal payments to physicians (“general payments” under Open Payments terminology) in aggregate, including payment types such as consulting fees, speaker fees, and food/beverage together (Table 1, Appendix Table 2). 1 study analyzed industry payments supporting research (“research payments” under Open Payments terminology) (34), and 3 studies analyzed the sum of general payments and research payments (35–37). 9 studies presented analyses of the payment-prescribing association across different categories of general payments (31,32,38–44). Though there was heterogeneity regarding how general payments categories were grouped, 6 of the 9 studies compared food & beverage payments to other payment categories. Of these, 5 studies found that the magnitude of the payment-prescribing association was greater among food & beverage payments (31,32,40,41,44), while 1 study found a stronger association with other payment types such as consulting and compensation (42). 2 studies analyzed food & beverage payments only and found a positive association (38,39), and 1 study found a positive association for travel & lodging payments (43).

Types of prescribing outcomes

The most common prescribing outcome was *prescribing volume for the drug of interest* (15 studies) (Table 1, Appendix Table 2). 8 studies measured the *fraction of prescriptions for the drug of interest*, taking into account prescribing volume for other drugs within the same class or substitutable alternatives. 6 studies measured *the fraction of prescriptions for branded drugs* (either within class of overall). 10 studies measured prescribing in terms of the *prescribing costs for the drug of interest*. 1 study assessed a range of prescribing quality measures.

Temporal association

A total of 9 studies included analyses which assessed the temporal relationship between payments and prescribing (Table 1, Appendix Table 2). 6 of these assessed the temporal relationship by analyzing the receipt of payments with respect drug prescribing in *subsequent* calendar years (34,39,42,45–47). One also applied propensity score matching to control for prior payments and prescribing patterns in order to estimate the association between incident payments and future prescribing.

3 studies assessed temporality by conducting *time series analyses*. One of these used data from a single hospital pharmacy to assess the utilization of two different drugs before and after physicians at that hospital were exposed to payments from those drugs' manufacturers (43). The other 2 studies constructed within-physician time series, comparing prescribing immediately after receipt of a payment to each physician's past prescribing history (31,32).

Dose-response relationship

Of the 36 studies, 25 assessed for a dose-response relationship between payments and prescribing (Table 1, Appendix Table 2). These studies analyzed payments as either a continuous or categorical variable, assessing whether receipt of more payments (in terms of payment count or dollar value) was associated with greater changes in prescribing compared to receipt of less payments. All 25 studies found evidence of a dose-response relationship in one or more of their primary analyses.

Discussion

Prior work has established that interaction with the drug industry influences physician formulary recommendations (48), clinical research (49–52), and clinical practice guideline recommendations (53). Published reviews (identified by MEDLINE search) have also found that physician-industry interactions influence prescribing (17–21). However, the older studies included in these reviews measured interactions in non-financial terms, such as frequency of sales representative office visits or physician participation in sponsored education events. More recently, enabled by the availability of Open Payments data, direct measures of financial COI have become possible.

In this review, we therefore focused on studies that measured physician-industry interactions in solely financial terms. Each included study found a positive association between payments and prescribing in one or more of its constituent analyses. These analyses included several types of prescribing decisions, finding that physicians who received industry payments were more likely to prescribe drugs made by the companies that had paid them over alternatives, had higher prescribing costs, and prescribed relatively more brand-name products over generic alternatives. The positive results of these studies spanned a broad range of physician specialties and drug classes. The consistency of the payment-prescribing association across the type of prescribing decision, physician specialty, and drug class suggests that financial payments are an important mechanism by which physician-industry interactions influence prescribing.

Several mechanisms may explain the observed association. First, payments may cause prescribing: receiving payments from a drug company may lead a physician to prescribe more of that company's drug in the future. Second, prescribing may cause payments: drug companies may target payments to physicians who are already high prescribers of their drugs. Both mechanisms are plausible. To shape policy around acceptance of payments, it is critical to understand the relative importance of these mechanisms.

9 of the studies included in this review evaluated the temporal relationship between payments and prescribing to approach the question of causality. Analyzing prescribing with respect to payments received in previous years – an approach used by six included studies – supports the mechanism of payments causing prescribing. However, the strongest evidence for a causal relationship comes from the three studies that conducted time series analyses (31,32,43). Each of these studies reported substantial increases in prescribing occurring immediately after receipt of each industry payment. Though these results do not exclude the possibility that manufacturers may also target payments to physicians who are already high prescribers, these findings strongly suggest that industry payments cause physicians to change their prescribing practices. A causal relationship is further supported by the dose-response analyses conducted by the majority of included studies, which consistently found that increasing numbers or dollar value of payments is associated with greater differences in prescribing.

25 of the studies conducted analyses that measured prescribing (either volume or cost) of only the drug[s] of interest. These outcomes have the potential for confounding by factors that may influence "opportunities to prescribe," such as case volume and physician specialty. Though some studies controlled for physician specialty, there may be residual confounding; even within a specialty, physicians may focus on different diseases and therefore have differential opportunities to prescribe the drugs that treat them. Measuring prescribing in terms of the fraction of relevant prescriptions may be a better measure of physician prescribing preferences, because it incorporates the denominator of patients who were indicated for treatment. The positive associations reported by the 14 studies that measured fractional prescribing (of either a specific drug of interest, or of branded drugs in general) suggest that payments do shift physicians' prescribing towards promoted drugs, and that the payment-prescribing association is not fully explained by "opportunities to prescribe."

The cross-sectional design of most included studies allows for the possibility that some of the observed payment-prescribing association may be accounted for by manufacturers targeting payments to physicians who are already high prescribers, or potentially by other mechanisms. More research is needed to better understand the factors contributing to the overall association between payments and prescribing. While the association is likely multifactorial, our findings suggest that a causal relationship of payments on prescribing is an important contributing factor to the overall association.

The influence of industry payments on prescribing raises questions regarding the quality of care. In cases where patients would benefit from increased utilization of a high-value drug, it is very plausible that industry payments might lead to improved patient outcomes. However, the distribution of industry payments makes it unlikely that patients would achieve improved

outcomes in aggregate: industry spending on drug promotion disproportionately targets drugs that are less effective or offer little therapeutic advancement (54,55). This may be because physicians are more inclined to use effective, innovative drugs regardless of promotion, while marginally-effective drugs require more intensive promotion to increase prescribing (54,55).

Empiric findings further suggest that industry drug promotion may lead to lower-quality prescribing. A systematic review of primarily non-financial physician-industry interactions found them to be consistently associated with inappropriate and lower-quality prescribing (17). In another review, a majority of studies found an association between the receipt of industry information and lower-quality prescribing (21). Results from studies in the current review also support this conclusion. Several studies reported associations between industry payments and increased prescribing of low-value drugs – including both less-effective drugs and those that are similarly effective but more expensive that competitors – over higher-value alternatives such as less expensive generics (38,56–63). One study stratified patients by CHADS2 and HAS-BLED scores and found that payments were associated with similar increases in low-risk and high-risk anticoagulant prescribing (32). Another found that payments were associated with a range of adverse prescribing quality measures, such as benzodiazepine prescriptions >12 weeks duration and vasodilator prescriptions for patients aged >65 years (64). Another study found evidence of “product hopping,” the promotion of a newer product in anticipation of patent expiration on an older product (65). Specifically, industry payments were associated with increased use of nilotinib for treatment of chronic myeloid leukemia, ahead of market entry of generic imatinib (34). As imatinib has better real-world safety compared to nilotinib (66), payments promoting nilotinib may result in both increased costs and worse outcomes. Further research is needed to understand more fully the potential for industry payments to affect care quality and patient outcomes.

Despite longstanding concerns regarding the potential for industry influence on medical practice, industry payments to physicians remain common. Federal regulation – the Sunshine Act – has been limited to ensuring transparent disclosure of payments and has not directly attempted to reduce them. An important barrier to reform has been physician opposition (67). Historically, the majority of physicians has believed that receiving industry gifts is appropriate and that this practice should continue (68–70). Physicians’ opposition to ending financial payments from the drug industry may be rooted in the belief that accepting such payments will not affect their practice (16,68,71,72). Our findings suggest that this belief is not well-founded.

This analysis has limitations related to characteristics of the included studies. Most studies relied on Open Payments data, which is known to contain some errors (28). However, both random errors and attribution of payments to physicians when no true COI exists (eg., funding of academic grants awarded by third party organizations) (29) would be expected to bias results towards the null. Open Payments does not include nurse practitioners or physician assistants; these provider groups will be added in the 2021 reporting year. Most studies focused on prescribing within Medicare, which may limit generalizability to other patient groups, such as the commercially insured or the uninsured. Few studies examined industry research funding; more work is needed to understand whether this form of payment

is also associated with physician prescribing. Because of the observational design of the included studies, the causality of the payment-prescribing association cannot be determined. However, the temporal association between payments and prescribing observed in several studies strongly suggests a causal relationship. Results of the included studies may be subject to publication bias. However, in the context of studies on industry payments, publication bias against studies reporting null results may be less likely; all of the studies we identified found a positive association between payments and prescribing in some of their analyses, and a study finding a robust, null association would therefore have been a novel contribution to the literature and of high interest to journals.

The strength of evidence is reduced by the fact that the majority of studies had serious ROB, and no study had low ROB. However, some of the studies with moderate ROB received this assessment only because of 1) observational design and 2) use of Open Payments data, and were unlikely to have other sources of bias. That these studies also identified a payment-prescribing association increases confidence in the overall results.

We present evidence that receipt of financial payments from industry is consistently associated with increased prescribing. This association has been identified across a broad range of physician specialties, drug classes, and prescribing decisions. Additionally, evidence of a temporal association and dose-responsiveness strongly suggests a causal relationship. We also find evidence, consistent with prior studies, that industry payments are associated with increased use of lower-value drugs. Taken together, our results support the conclusion that personal payments from industry reduce the ability of physicians to make independent therapeutic decisions and that they may be harmful to patients. The medical community must change its historical opposition to reform and call for an end to such payments.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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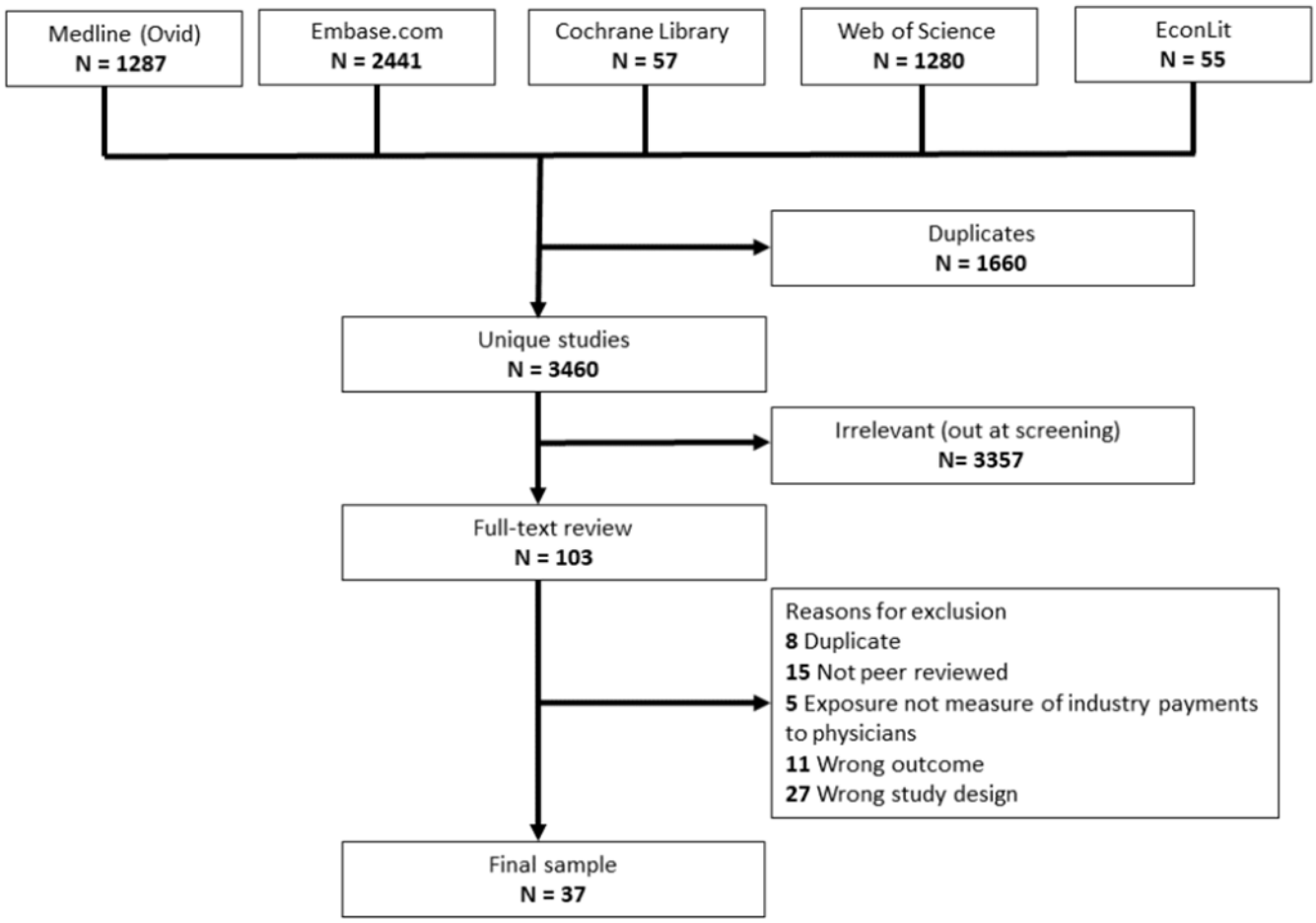

Figure 1.
Study Selection.

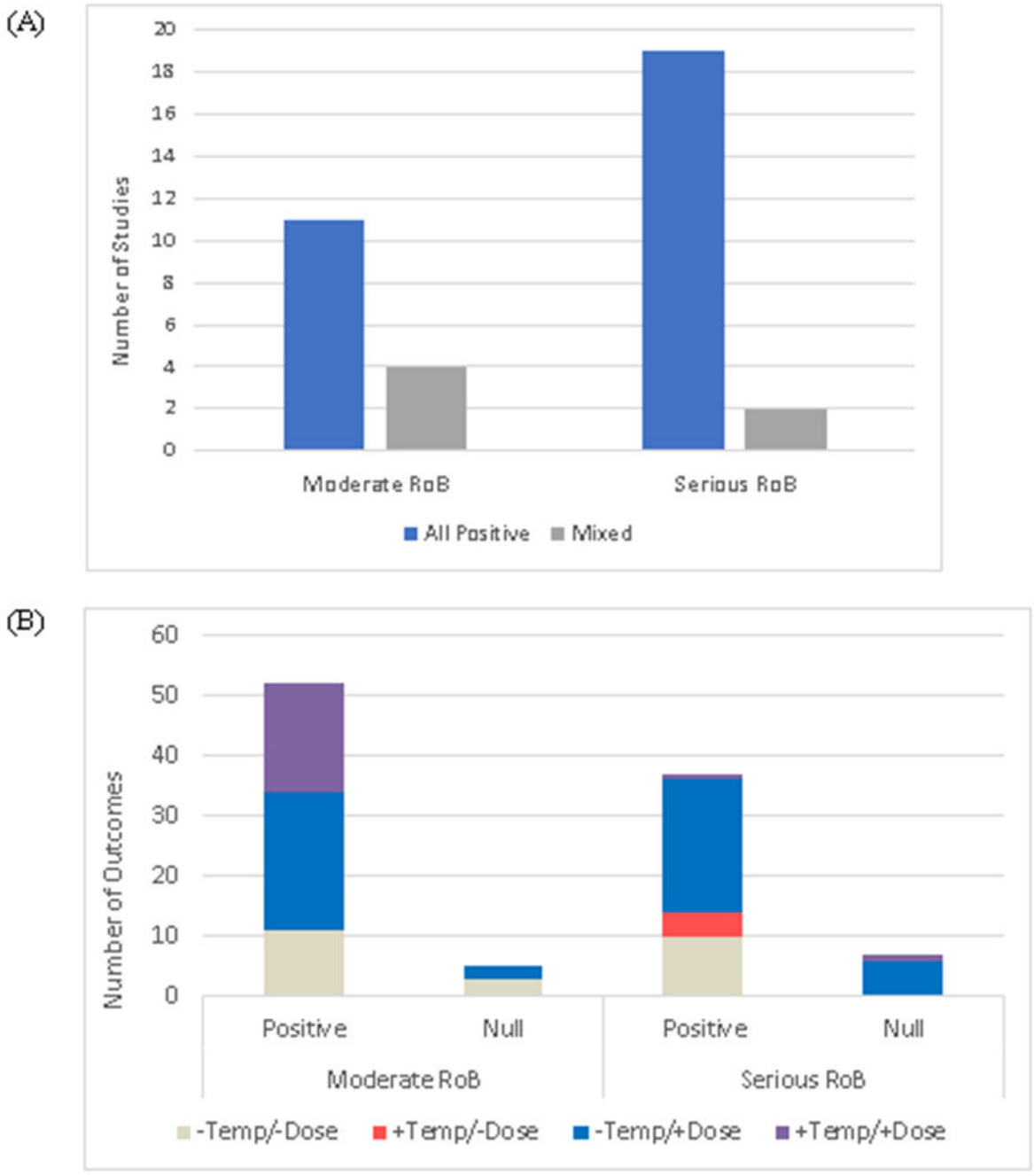

Figure 2:

Study results regarding the presence of a positive association between industry payments and prescribing. Results are shown on the level of the overall study (2A) and the individual analyses (2B). For studies, results were characterized as “all positive” (all analyses within that study had a positive association) or “mixed” (some analyses within that study had a positive association and some were null). For individual analyses, results were characterized as “positive” (increased industry payments associated with increased prescribing), “inverse” (increased industry payments associated with reduced prescribing), or “null” (no statistically

significant association). Individual outcomes were also characterized as having assessed for a temporal association (+Temp/−Dose), a dose-response association (−Temp/+Dose), neither (−Temp/−Dose), or both (+Temp/+Dose).

Table 1:

Study characteristics. For Type[s] of prescribing outcome assessed, "prescribing volume" indicates that the measured outcome was the number of prescriptions or claims for the drug[s] of interest; "prescribing costs" indicates the financial cost (eg., Medicare reimbursement) of prescriptions for the drug[s] of interest; "fraction of prescribing for drug of interest" indicates the proportion of prescriptions or claims for the drug[s] of interest within the drug class or within an identified set of substitutable medications; "fraction of prescribing for branded drugs" indicates the proportion of prescriptions or claims for the drug[s] of interest that were for branded versions rather than generics.

Characteristic	Number of studies (%)
Year of publication	
1992	1 (2.8)
2016	4 (11.1)
2017	6 (16.7)
2018	9 (25.0)
2019	11(30.6)
2020	5 (13.9)
Route of administration of drugs studied	
Oral	28 (77.8)
Subcutaneous	3 (8.3)
Intravitreal	3 (8.3)
Intravenous	1 (2.8)
Intranasal	1 (2.8)
Class of drugs studied	
Multiple drugs from different classes	11 (30.6)
Opioids	7 (19.4)
Antineoplastic	3 (8.3)
Anti-VEGF	3 (8.3)
Biologics for inflammatory bowel disease	1 (2.8)
Erectile dysfunction	1 (2.8)
Gabapentinoids	1 (2.8)
Intranasal corticosteroids	1 (2.8)
Multiple sclerosis drugs	1 (2.8)
Alpha blockers and overactive bladder drugs	1 (2.8)
Proton-pump inhibitors	1 (2.8)
Statins	1 (2.8)
Tumor necrosis factor inhibitors	1 (2.8)
Anticoagulant	1 (2.8)
Antipsychotic	1 (2.8)
NMDA receptor antagonist	1 (2.8)
Data source for industry payments	
Open Payments	32 (88.9)
Any other source	4 (11.1)

Characteristic	Number of studies (%)
Data source for physician prescribing	
Medicare (Public Use File)	29 (80.6)
Medicare (Opioid Supplement)	2 (5.6)
Medicare (Claims)	2 (5.6)
Medicare (Freedom of Information Act request)	1 (2.8)
Hospital inventory	1 (2.8)
French National Health Data System	1 (2.8)
Type[s] of prescribing outcome assessed [§]	
Prescribing volume for the drug of interest	15
Prescribing costs for the drug of interest	10
Fraction of prescribing for drug of interest	8
Fraction of prescribing for branded drugs	6
Other [*]	1
Physician Specialty [§]	
All Physicians [†‡]	22
Cardiology	2
Gastroenterology	2
Hematology-Oncology	5
Nephrology	2
Neurology	3
Ophthalmology	3
Primary Care	5
Psychiatry	2
Rheumatology	2
Urology	4
Other (Chiropractic, Dentistry, Dermatology, Endocrinology, General Surgery, Optometry, Otolaryngology)	7
Categories of Industry Payments Assessed [§]	
All general payments	30
Subsets of general payments	9
All general and research payments combined	3
All research payments	1
Temporal Relationship Evaluated	
Yes	9 (25.0)
No	27 (75.0)
Dose-Response Relationship Evaluated	
Yes	25 (69.4)
No	11 (30.6)
Geographic region	
Entire US	32 (88.9)
US state, municipality, or hospital	3 (8.3)
France	1 (2.8)

[*] Outcome was a range of prescribing quality measures.

[†] Two papers included all clinicians (Physicians, Nurse Practitioners, etc.).

[‡] One paper included all physicians, except gastroenterologists.

[§] This category sums to >36 because some studies contained multiple categories