



Disclosure of Industry Payments to Physicians: An Epidemiologic Analysis of Early Data From the Open Payments Program

Deborah C. Marshall, MAS; Madeleine E. Jackson, BA;
and Jona A. Hattangadi-Gluth, MD

Abstract

The Centers for Medicare and Medicaid Services' Open Payments program implements Section 6002 of the Affordable Care Act requiring medical product manufacturers to report payments made to physicians or teaching hospitals as well as ownership or investment interests held by physicians in the manufacturer. To determine the characteristics and distribution of these industry payments by specialty, we analyzed physician payments made between August 1, 2013, and December 31, 2013, that were publicly disclosed by Open Payments. We compared payments between specialty types (medical, surgical, and other) and across specialties within each type using the Pearson χ^2 test and the Kruskal-Wallis test. The number of physicians receiving payments was compared with the total number of active physicians in each specialty in 2012. We also analyzed physician ownership interests. Allopathic and osteopathic physicians received 2.43 million payments totaling \$475 million. General payments represented 90% of payments by total value (\$430 million) (per-physician median, \$100; interquartile range [IQR], \$31-\$273; mean \pm SD, \$1407 \pm \$23,766), with the remaining 10% (\$45 million) as research payments (median, \$2365; IQR, \$592-\$8550; mean \pm SD, \$12,880 \pm \$66,743). Physicians most likely to receive general payments were cardiovascular specialists (78%) and neurosurgeons (77%); those least likely were pathologists (9%). Reports of ownership interest in reporting entities included \$310 million in dollar amount invested and \$447 million in value of interest held by 2093 physicians. In conclusion, the distribution and characteristics of industry payments to physicians varied widely by specialty during the first half-year of Open Payments reporting.

© 2016 Mayo Foundation for Medical Education and Research ■ Mayo Clin Proc. 2016;91(1):84-96



From the Department of Radiation Medicine and Applied Sciences, University of California, San Diego, La Jolla, CA (D.C.M., J.A.H.-G.); and University of California, San Diego School of Medicine, La Jolla, CA (D.C.M., M.E.J.).

The recently debuted Centers for Medicare and Medicaid Services' (CMS) Open Payments transparency program establishes a national database of industry payments to physicians and teaching hospitals.¹ Financial relationships between medical product manufacturers and physicians have long been a source of concern to patients and policymakers alike. These concerns have grown in recent years as research continues to show the ways in which these widely prevalent relationships² may affect treatment decisions and may drive health care costs due to inappropriate utilization.^{3,4} In their report calling for broad transparency of industry-physician relationships, the Institute of Medicine "defines a conflict of interest as existing when an individual or institution has a secondary interest...

that creates a risk of undue influence on decisions or actions affecting a primary interest (eg, the conduct of objective and trustworthy medical research). This definition frames a conflict of interest in terms of the risk of such undue influence and not the actual occurrence of bias."^{3,p26} In many cases, industry-physician financial relationships, from transfers of value as small as a meal or gift to those for royalties and licensing fees, create a conflict of interest.³⁻⁵

As a result of concerns about these financial conflicts of interest, several legislative efforts have been made over the years to increase transparency with respect to industry-physician relationships. Before Open Payments implementation, several states enacted laws requiring various levels of disclosure of industry payments to

physicians,⁶ including full transparency, disclosure to the state, compliance with professional guidelines,⁷ and limits on gifts. However, only 8 states had such laws before Open Payments implementation.⁶ In addition to these laws, several pharmaceutical and device manufacturers publicly disclosed payments, although with varying detail.⁸ Kesselheim et al,⁹ in their evaluation of Massachusetts physician payment transparency data, found wide variation among specialties. They speculated that there may be differences in industry incentive to engage in such relationships or that specialties may have differences in the acceptance of these relationships.

Federal policymakers have attempted to increase the transparency of industry-physician financial relationships, although attempts between 2002 and 2009 failed to gain enough support for the bills to pass.¹⁰⁻¹² Finally, in 2010, the Physician Payment Sunshine Act was signed into law as Section 6002 of President Obama's Patient Protection and Affordable Care Act,¹³ leading to establishment of the Open Payments program. The stated goal of the Sunshine Act and Open Payments is to "shed light on the nature and extent of [industry-physician] relationships and ... hopefully discourage the development of inappropriate relationships and help prevent the increased and potentially unnecessary health care costs that can arise from such conflicts."^{1, p9549} The Open Payments data release was updated in December 2014 and includes 4.5 million records of \$3.7 billion in total value for payments occurring between August 1, 2013, and December 31, 2013. These data, despite representing only 5 months of 2013, are the most comprehensive to date describing physician-industry relationships in the United States. Physician payments reported to Open Payments include payments of greater than \$10 or \$100 in aggregate annually (adjusted based on the consumer price index), with notable exceptions, including product samples, discounts, charity care, and patient educational materials.¹

Much of the existing literature on the Open Payments program is speculative, published before availability of the data, but provides important insight into the possible uses and impact of the data. For example, Rosenthal and Mello¹⁴ speculated on the use of Open Payments data by attorneys, insurance carriers,

researchers, policymakers, and patients. The debate on the influence of conflicts of interest on physician decision making is ongoing,¹⁴⁻¹⁶ with researchers acknowledging that there is little evidence to answer such questions. Analysis of these newly available data may bring a better understanding of the differences and commonalities between specialties in their relationships with industry. Such knowledge may help determine how to assess the appropriateness of these relationships and their effects on clinical practice and may help inform evidence-based advocacy efforts as ongoing federal transparency efforts shift the landscape of disclosure for physicians.

The purpose of this study was to characterize Open Payments program records of industry payments to physicians and determine how these payments vary by specialty. We hypothesized that there would be differences in the characteristics and distribution of payments by physician specialty.

METHODS

The Open Payments database allows for physician-level industry payment calculations and aggregation for analysis of broader characteristics by specialty. We performed a retrospective analysis of the most recent (December 2014) publicly available release of Open Payments data on industry payments (>\$10 or \$100 in aggregate annually) to identified physicians made between August 1, 2013, and December 31, 2013. The CMS excludes resident and manufacturer employee physicians. The data released also include payments to teaching hospitals, but these are beyond the scope of this article. Payments to recipient physicians were available in identified and deidentified databases. Identified physician payments included records of payments or other transfer of value (physician payments) to a specific physician and included physician specialty designation. Recipient physicians include allopathic and osteopathic specialties and other practitioners designated as physicians by the CMS. We further limited this analysis to allopathic and osteopathic physician specialties that could be matched with the American Medical Association Physician Masterfile count of active physicians.¹⁷ Data were aggregated by physician specialty type (medical, surgical, and other) and by specialty within each type.

Medical specialties include allergy and immunology, dermatology, family medicine and general practice, cardiovascular disease, gastroenterology, internal medicine, pediatrics, and pediatric cardiology. Surgical specialties include colorectal surgery, neurosurgery, obstetrics and gynecology, ophthalmology, oral and maxillofacial surgery, orthopedic surgery, otolaryngology, plastic surgery, surgery (general), thoracic surgery, and urology. Other specialties include anesthesiology, emergency medicine, neurology, pathology, psychiatry, radiology, and other. A listing of the specialty groupings is provided to delineate the specialty taxonomy used for this analysis (Supplemental Table 1, available online at <http://www.mayoclinicproceedings.org>). Records include information on reporting manufacturers, physicians, payments, associated drugs or devices, and ownership interests.

We characterized payments as general or research. General payments include all forms of payment other than those for research activities, which are classified under research payments (defined in the next paragraph). General payments were also characterized by form of payment or the modality used to transfer payment, including cash or cash equivalent; in-kind items and services; dividend, profit, or other return on investment; and stock, stock option, or other ownership interest (ownership interest). General payments were further classified by nature of payment, or the reason the general payment was made. The CMS provides descriptive titles for each nature of payment classification and has examples of payment types that were developed with stakeholder input available on their website (<https://www.cms.gov/OpenPayments/About/Natures-of-Payment.html>, accessed June 15, 2015). An adapted version of the CMS descriptions is given in Supplemental Table 2 (available online at <http://www.mayoclinicproceedings.org>).

Research payments include any direct compensation, funding for coordination or implementation, or study participant expense payment associated with research activities.¹ Research is defined in the regulations as “a systematic investigation designed to develop or contribute to generalizable knowledge relating broadly to public health, including behavioral and social-sciences research. This term encompasses basic and applied research and product

development.”^{1,p9482} Research-related payments are reported separately from general payments due to the complexity of research programs.¹ In addition, certain research payments qualify for delayed publication if they are related to new, additional applications of or clinical investigations regarding a drug, biologic, device, or medical supply.¹ Research payments are not required to report an expenditure category (similar to nature of payment for general payments) because there are often several, although the option to report such a category is available. Ninety-one percent of research payment records did not specify an expenditure category; therefore, we did not further explore this classification. We present summarized aggregate data, data by specialty type, and data by physician specialty (organized by specialty type). Payment characteristics analyzed included number of payment reports, value of payments, and per-physician median and mean payment amounts.

Last, we characterized physician and immediate family member ownership interests in manufacturers. Ownership interests include any ownership or investment interests of physicians or immediate family members in a reporting entity (applicable manufacturer or group purchasing organization) required to report payments.¹ Ownership interests include stocks, stock options, partnership shares, limited liability company membership(s), and loans, bonds, or other financial instruments secured by the reporting entity; notable exclusions include ownership interests received as compensation (until exercised), as part of a retirement plan, or interest in a publicly traded security or mutual fund.¹ Unless listed under general payments, ownership interests must be held within the defined reporting period but are not necessarily transferred. To characterize ownership and investment interest data, we used the CMS terms *amount invested* and *value of interest* to delineate the original amount of the interest holding or transfer of value and the cumulative value of that ownership interest in the reporting entity at the end of the reporting period, respectively.¹⁸ Ownership interest characteristics analyzed included the number of ownership interests held and the total and per-physician median dollar amounts invested and value of interest.

We analyzed how payment and ownership interest characteristics vary among specialty

TABLE 1. Nature of General Payments to Recipient Physicians, August 1, 2013, Through December 31, 2013^{a,b}

Nature of payment or transfer of value	All general payments		Identified general payments	
	General payments [No. (% of total)]	Total value [\$ (% of total)]	General payments [No. (% of total)]	Total value [\$ (% of total)]
Charitable contribution	317 (<1)	270,769 (<1)	232 (<1)	149,089 (<1)
Compensation for services other than consulting, including serving as faculty/speaker at a non-CME program	118,274 (3)	189,211,910 (25)	75,514 (3)	112,549,967 (24)
Compensation for serving as faculty/speaker for a nonaccredited and noncertified CME program	7152 (<1)	15,021,864 (2)	4411 (<1)	9,773,642 (2)
Compensation for serving as faculty/speaker for an accredited or certified CME program	927 (<1)	4,375,863 (<1)	399 (<1)	1,233,613 (<1)
Consulting fee	67,297 (2)	147,813,521 (19)	45,989 (2)	94,005,913 (20)
Current or prospective ownership or investment interest	2047 (<1)	14,975,459 (2)	1587 (<1)	8,524,147 (2)
Education	187,436 (4)	20,559,345 (3)	128,044 (5)	12,772,469 (3)

^aCME = continuing medical education.
^bNature of payment is the reason general payment was made.

types and across physician specialties within each type using the Pearson χ^2 test and the Kruskal-Wallis test where applicable. We compared the number of physicians receiving payments with the total number of active physicians in each specialty in 2012¹⁷ to estimate the proportion of physicians receiving payment and holding ownership interest.

RESULTS

From August 1, 2013, through December 31, 2013, there were 4.4 million payments totaling \$2.6 billion reported to Open Payments, with 2.7 million of these payments (\$869 million) disclosed in an identified manner. General payments represented 4.2 million of all payments (\$1.0 billion) and 2.7 million of the identified payments (\$693 million). Recipient physicians received 4.2 million of all general payments (\$761 million), and identified recipient physicians received 2.6 million payments totaling \$476 million. The nature of all general payments to recipient physicians and of the subset of identified payments are presented in Table 1. The nature of identified general payments to recipient physicians by total value was primarily compensation for services (\$113 million [24%]), royalty/license payments (\$107 million [22%]), and consulting fees (\$94 million [20%]); by number of records, they were primarily food/beverage (2.2 million [84%]).

Allopathic and osteopathic physicians received 2.4 million payments totaling \$475 million (Table 2). Figure 1 shows the distribution

of payments among allopathic and osteopathic specialties. Internal medicine and orthopedic surgery had the greatest total value (\$111 million each) (Figure 1, A); however, payments were distributed to a greater number of internal medicine physicians vs orthopedic surgeons (77,515 vs 15,459). The medical specialties that received the greatest number of payments were cardiovascular disease (78%) and gastroenterology (68%). The proportion of physicians receiving payment was significantly different between specialty types and by specialty within each type ($P < .001$ for all tests). Form of payments (Figure 1) was primarily cash or cash equivalent (\$367 million [77%] by value, 469,557 (19%) by number) or in-kind items and services (\$103 million [22%] by value, 2.0 million [81%] by number), with the remaining payments as dividend, profit, or other return on investment (\$421,769 [0.1%] by value, 48 [$<0.1\%$] by number) and ownership interest (\$4.8 million [1%] by value, 66 [$<0.1\%$] by number).

General payments represented \$430 million (90%) of the total value of payments to allopathic and osteopathic physicians (per-physician median, \$100; interquartile range [IQR], \$31-\$273; mean \pm SD, \$1407 \pm \$23,766) and 2.4 million (99%) of the number of records. The remaining \$45 million (10%) of the total value was research payments (median, \$2365; IQR, \$592-\$8550; mean \pm SD, \$12,880 \pm \$66,743). Thoracic surgery, cardiovascular disease, and urology had the highest median general payments, and orthopedic surgery, neurosurgery,

TABLE 2. Industry Payments to Allopathic and Osteopathic Physicians by Specialty Type and Specialty, August 1, 2013, Through December 31, 2013^a

Specialty	All identified payments ^b				Identified general payments ^b				
	Total payment records (No.)	Total value (\$)	Active physicians (No.) ^c	Physicians receiving payment (No. [%]) ^d	Total general payment records (No.)	Total value of general payments (\$) ^e	Per-physician median value of general payments (\$ [IQR])	Per-physician mean value of general payments (\$ [SD])	Largest general payment (\$)
All allopathic and osteopathic specialties ^f	2,428,437	474,676,057	813,123	324,523 (40)	2,415,449	429,889,790	100 (31-273)	1407 (23,766)	7,356,000
Specialty type ^f									
Medical	1,646,144	206,179,711	417,130	187,354 (45)	1,636,765	176,013,917	100 (31-268)	976 (9797)	2,150,000
Surgical	428,475	197,131,503	167,314	81,444 (49)	426,497	188,814,432	99 (32-286)	2383 (43,742)	7,356,000
Other	353,818	71,364,843	228,679	55,725 (24)	352,187	65,061,441	83 (25-216)	1195 (7953)	687,600
Medical specialties									
Allergy and immunology	17,394	3,947,834	4413	2426 (55)	17,170	2,885,335	107 (39-259)	1194 (5074)	88,000
Cardiovascular disease	208,107	35,606,531	23,085	18,114 (78)	205,392	33,755,702	175 (61-519)	1866 (8489)	445,000
Dermatology	54,295	8,130,678	11,772	7441 (63)	54,143	7,294,757	106 (32-283)	980 (4624)	93,930
Family medicine and general practice	468,331	21,408,772	98,365	53,781 (55)	467,216	18,064,870	80 (25-206)	336 (6099)	734,600
Gastroenterology	93,205	15,623,526	13,826	9406 (68)	92,737	14,732,864	149 (56-373)	1569 (19,167)	1,716,000
Internal medicine	748,420	111,148,259	182,540	77,515 (42)	744,183	92,322,945	103 (32-280)	1152 (11,148)	2,150,000
Pediatrics	55,283	9,843,206	80,822	18,324 (23)	54,838	6,585,667	38 (17-91)	358 (3553)	232,300
Pediatric cardiology	1109	470,905	2307	347 (15)	1086	371,777	76 (23-196)	1087 (4402)	51,320
Surgical specialties									
Colorectal surgery	5330	1,529,758	1568	857 (55)	5324	1,501,093	141 (47-618)	1754 (5886)	86,000
Neurosurgery	26,382	17,871,297	6041	4632 (77)	26,327	17,406,424	88 (30-391)	3763 (30,761)	1,253,000
Obstetrics and gynecology	82,349	10,241,341	43,527	18,621 (43)	82,042	9,070,036	62 (24-138)	488 (4383)	337,300
Ophthalmology	56,874	14,218,156	18,805	9894 (53)	56,121	10,970,900	113 (36-250)	1111 (8111)	397,800
Oral/maxillofacial surgery	655	268,380	455	277 (61)	654	264,455	64 (23-146)	955 (6252)	80,020
Orthopedic surgery	80,951	110,704,562	25,670	15,459 (60)	80,784	109,885,624	120 (35-612)	7114 (94,658)	7,356,000
Otolaryngology	15,732	2,990,801	10,466	4625 (44)	15,708	2,611,438	71 (26-160)	565 (2770)	60,680
Plastic surgery	12,207	4,330,005	7726	2865 (37)	11,877	3,880,534	114 (34-326)	1363 (8848)	341,400
Surgery (general)	70,603	21,811,190	37,739	15,387 (41)	70,396	20,342,511	99 (30-306)	1324 (20,713)	2,305,000
Thoracic surgery	15,259	4,562,545	4544	2499 (55)	15,204	4,417,545	181 (60-840)	1771 (7664)	159,400
Urology	62,133	8,603,467	10,773	6328 (59)	62,060	8,463,872	169 (59-503)	1339 (6449)	250,900
Other specialties									
Anesthesiology	37,252	6,297,362	44,555	9855 (22)	37,208	6,089,848	43 (16-123)	618 (4508)	202,100
Emergency medicine	13,780	2,904,024	35,937	6271 (17)	13,732	2,679,681	28 (14-100)	428 (4324)	191,800
Neurology	101,371	20,609,422	16,810	8282 (49)	100,995	19,335,051	147 (51-508)	2342 (9800)	278,700
Pathology	3,731	2,219,969	18,922	1614 (9)	3701	2,030,903	60 (20-125)	1264 (8220)	193,200
Psychiatry	136,358	22,018,887	47,833	16,399 (34)	135,421	21,077,442	110 (57-260)	1288 (7478)	212,000
Radiology	22,428	9,947,863	40,922	7034 (17)	22,273	7,022,774	66 (22-180)	1003 (10,933)	687,600
Other	38,898	7,367,316	23,700	6270 (26)	38,857	6,825,742	75 (24-197)	1091 (8316)	286,300

^aIQR = interquartile range.^bAll identified payments are payments to an identified recipient physician, regardless of the type of payment (research or general). Identified general payments are the subset of payments made for any reason other than for research.^cCalculated using the number of active physicians for each specialty in 2012 obtained from American Medical Association Physician Masterfile data.¹⁷^dThe proportion of physicians paid differed significantly among specialty types and across specialties within each type (Pearson χ^2 test, $P < .001$ for all comparisons).^eThe value of general payments differed significantly among specialty types and across specialties within each type (Kruskal-Wallis test, $P < .001$ for all comparisons).^fDue to rounding, some of the totals may not correspond to the sum of the subtotals.

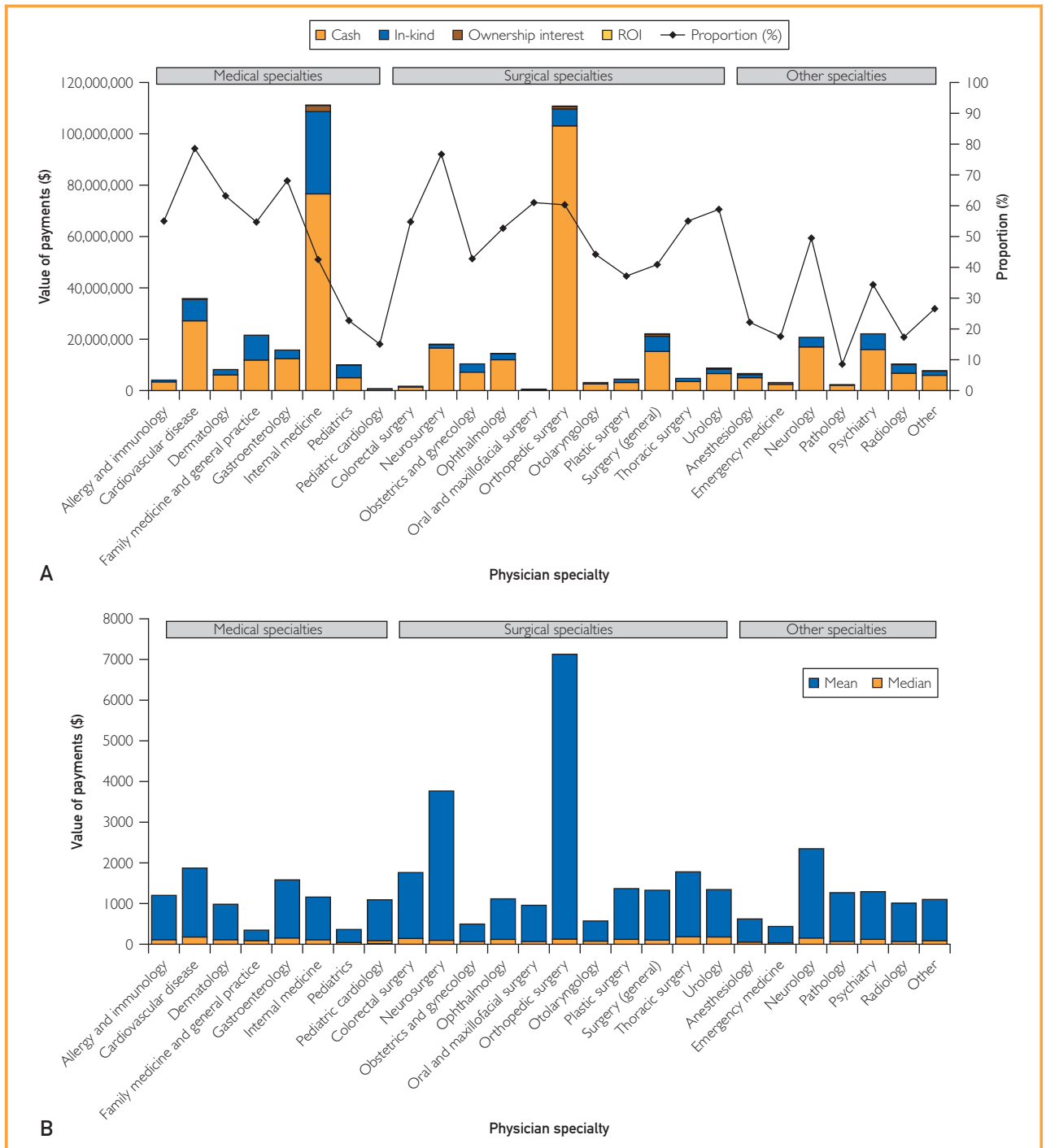
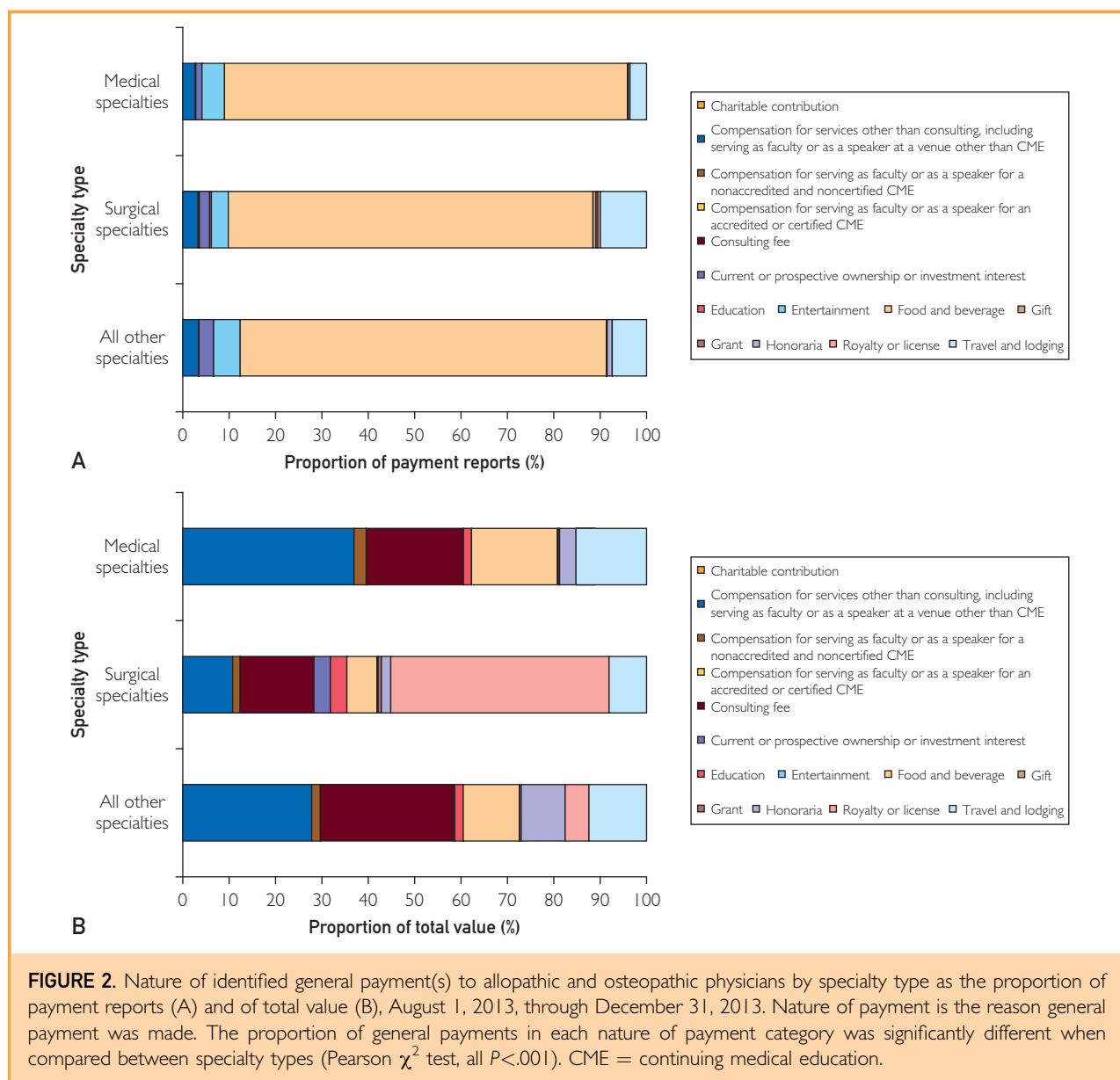


FIGURE 1. Industry payments to allopathic and osteopathic physicians by specialty, August 1, 2013, through December 31, 2013. A, Total value of payments by form of payment and proportion of physicians receiving payments. The proportion of payments in each form of payment category and the proportion of physicians receiving payment were significantly different across specialties within each type (Pearson χ^2 test, all $P < .001$). B, Mean and median per-physician value of general industry payments. The per-physician value of general payments was significantly different across specialties within each type (Kruskal-Wallis test, all $P < .001$). Data include payments to identified physicians in allopathic and osteopathic specialties. Form of payment is the modality used to transfer payment, including cash or cash equivalent (cash); in-kind items and services (in-kind); dividend, profit, or other return on investment (ROI); and stock, stock option, or other ownership interest (ownership interest).



and neurology had the highest mean value of general payments per physician (Figure 1, B). The value of general payments was significantly different between specialty types and by specialty within each type ($P < .001$ for all tests). The distribution of the nature of payments by specialty type can be found in Figure 2 and Supplemental Table 3 (available online at <http://www.mayoclinicproceedings.org>). Surgical specialties had the greatest proportion of general payments for royalties/licensing (\$89 million [47%] in value, 2431 [$<1\%$] by number). Royalty/license payments to surgical

specialties encompassed 89% of the \$100 million total royalty/license payments made for all specialty types. The proportion of general payments in each nature of payment category differed significantly between specialty types and by specialty within each type ($P < .001$ for all tests).

Manufacturers also disclosed 3296 reports of 2093 individual physicians (0.3% of all physicians) with ownership interest (Table 3) totaling \$310 million in total dollar amount invested (median, \$12,520; IQR, \$3114-\$50,050) and \$447 million in total value of interest (median,

TABLE 3. Allopathic and Osteopathic Physicians' Ownership Interest in Entities Reporting to Open Payments by Specialty Type and Specialty, August 1, 2013, Through December 31, 2013^a

Physician specialty	Total records (No.)	Total dollar amount invested (\$) ^b	Per-physician median dollar amount invested (\$ [IQR])	Total value of interest (\$) ^c	Per-physician median value of interest (\$ [IQR])	Active physicians (No.)	Physicians with ownership interest (No. [% of total]) ^d
All allopathic and osteopathic specialties	3296	309,732,657	12,520 (3114-50,050)	446,722,819	15,640 (4747-72,880)	813,123	2093 (0.26)
Specialty types							
Medical	668	109,759,857	11,250 (100-45,380)	122,893,860	9961 (1000-50,000)	417,130	613 (0.15)
Surgical	2412	150,829,819	10,690 (4297-50,000)	252,470,807	13,990 (6903-68,440)	167,314	1303 (0.78)
Other	216	49,142,981	50,000 (10,190-110,300)	71,358,152	55,310 (15,500-150,000)	228,679	177 (0.08)
Medical specialties							
Allergy and immunology	6	273,545	20,250 (2418-78,980)	236,597	899 (191-72,840)	4413	6 (0.14)
Cardiovascular disease	103	45,401,145	72,500 (20,430-219,300)	47,115,102	57,490 (9029-200,000)	23,085	82 (0.36)
Dermatology	11	1,135,718	30,000 (25,000-150,000)	827,181	58,000 (7,456-150,000)	11,772	9 (0.08)
Family medicine and general practice	101	2,049,440	13 (10-285)	2,808,674	252 (114-892)	98,365	97 (0.10)
Gastroenterology	21	44,407,718	34,430 (2682-64,930)	41,910,224	27,850 (11,700-57,410)	13,826	20 (0.14)
Internal medicine	370	15,942,875	13,140 (1000-30,000)	29,198,748	16,610 (1000-42,770)	182,540	351 (0.19)
Pediatrics	56	549,416	50 (20-100)	797,334	1359 (406-2024)	80,822	48 (0.06)
Pediatric cardiology	0	NA	NA	NA	NA	2307	0
Surgical specialties							
Colorectal surgery	9	77,600	5950 (0-12,520)	138,822	9675 (3993-28,460)	1568	8 (0.51)
Neurosurgery	139	18,113,613	50,000 (20,000-136,900)	28,948,119	80,380 (25,760-209,200)	6041	117 (1.94)
Obstetrics and gynecology	49	45,177,593	10 (8-27,090)	43,410,134	398 (147-53,520)	43,527	44 (0.10)
Ophthalmology	72	8,408,084	49,980 (24,250-139,200)	31,160,165	96,900 (49,950-248,700)	18,805	66 (0.35)
Oral/maxillofacial surgery	0	NA	NA	NA	NA	455	0
Orthopedic surgery	511	60,377,284	50,000 (11,500-109,600)	88,029,175	50,000 (13,500-143,200)	25,670	385 (1.50)
Otolaryngology	25	3,416,882	9533 (9533-69,960)	8,534,038	9686 (9686-112,500)	10,466	24 (0.23)
Plastic surgery	8	1,528,715	30,000 (26,550-110,700)	1,646,186	99,600 (26,380-134,800)	7726	7 (0.09)
Surgery (general)	64	4,395,325	28,880 (2067-78,720)	29,773,281	42,820 (7025-142,700)	37,739	55 (0.15)
Thoracic surgery	21	1,099,408	12,800 (126-176,900)	4,518,110	75,680 (11,560-265,500)	4544	14 (0.31)
Urology	1514	8,235,315	6937 (3955-10,690)	16,312,777	7542 (5275-12,500)	10,773	583 (5.41)
Other specialties							
Anesthesiology	39	4,786,711	67,330 (17,250-165,800)	14,454,518	79,870 (25,480-257,000)	44,555	34 (0.08)
Emergency medicine	17	3,197,682	49,980 (24,250-146,500)	3,292,858	79,370 (17,220-150,000)	35,937	14 (0.04)
Neurology	12	424,982	27,500 (7083-50,000)	1,185,354	43,750 (15,770-142,300)	16,810	11 (0.07)
Pathology	7	339,064	9197 (0-79,600)	2,339,510	103,000 (38,800-336,800)	18,922	6 (0.03)
Psychiatry	9	869,191	73,580 (64,190-125,000)	1,221,293	71,910 (40,490-107,600)	47,833	8 (0.02)
Radiology	116	37,705,465	33,850 (6274-81,820)	47,311,353	50,000 (11,100-90,640)	40,922	91 (0.22)
Other	16	1,819,886	101,000 (50,000-163,900)	1,553,266	112,200 (51,010-190,900)	23,700	13 (0.05)

^aIQR = interquartile range; NA = not applicable.^bThe proportion of physicians with ownership interest differed significantly among specialty types and across specialties within each type (Pearson χ^2 test, $P < .001$ for all comparisons).^cThe total dollar amount invested differed significantly among specialty types and across specialties within each type (Kruskal-Wallis test, $P < .001$ for all comparisons except for across specialties within other specialties [$P = .001$]).^dThe total value of ownership interest differed significantly among specialty types and across specialties within each type (Kruskal-Wallis test, $P < .001$ for all comparisons except for across specialties within other specialties [$P = .11$]).

\$15,640; IQR, \$4747-\$72,880). We found significant differences in the total dollar amount invested between specialty types and by specialty within each type (Kruskal-Wallis test, $P < .001$ between specialty types and by specialty within medical and surgical specialties; $P = .001$ by specialty within other specialties). We also found that total values of interest between specialty types and by specialty within each type were significantly different for each comparison ($P < .001$ between specialty types and by specialty within medical and surgical specialties), except by specialty within other specialties ($P = .11$). Specialties most likely to have ownership interests were urology (583 of 10,773 [5%]), neurosurgery (117 of 6041 [2%]), and orthopedic surgery (385 of 25,670 [2%]). All other specialties had less than 1% of physicians with ownership interest. We found significant differences in the proportion of physicians with ownership interest by specialty type and by specialty within each specialty type ($P < .001$ for all tests).

DISCUSSION

This analysis of an unprecedented volume of physician-specific data on industry-related financial conflicts of interest shows wide variability in the prevalence and characteristics of industry payments to physicians by specialty. Although important analyses of Open Payments manufacturer and product data exist,^{19,20} little attention has been given to characteristics of physician data. A report by Jarvies et al²⁰ gave an initial account of the first release of Open Payments data in September 2014, focusing largely on manufacturer and product data. However, the data provided regarding physician specialties were limited to 5 specialties and provided aggregates that included ownership and investment interests in the totals, despite the difference in reporting of these records. Useful aggregation and analyses of Open Payments manufacturer and product data are also available from ProPublica¹⁹ and from the CMS in their recent report to Congress,²¹ although little attention has been given to characteristics of physician data. Before the enactment of Open Payments, ProPublica also assembled a separate important database of industry-physician financial relationships²² containing \$4 billion in payments disclosed by 17 pharmaceutical

companies between 2009 and 2013. Compared with the 4-year period evaluated by ProPublica, the Open Payments data presented herein report on a 5-month period that contains data on nearly the same total value of payments (\$3.7 billion in total).

The present findings are also important because the specialty variation in this analysis demonstrates that further interpretation of the impact of industry payments on physician decision making, health care costs, and utilization must incorporate the specialty-specific context of these data. We found significant differences in the distribution and median values of payments by specialty type and by specialty within each type. We found that general medical specialties (internal medicine and family medicine/general practice) were the target of a large proportion of industry payments (1.2 million of 2.4 million total [50%]), although the value of these payments tended to be lower than those of other specialties (\$133 million of \$475 million [28%] paid to allopathic and osteopathic specialties in this analysis). In addition, the medical specialties that involve a greater amount of intervention (cardiovascular disease, gastroenterology, and dermatology) had the highest proportion of physicians receiving industry payments. These data are consistent with previous evidence showing wide variation among specialties in an early evaluation of Massachusetts physician payment transparency data⁹ and in physician self-reports.^{2,23} These evaluations also found a high prevalence of payments with specialty variability and high values of payments attributed to cardiology and orthopedic surgery. In addition, these data differ from the Massachusetts data in the nature of payments by providing additional detail to the distribution of payments, where a large proportion of Massachusetts payments fell under the broad category of “compensation for bona fide services.”⁹ Other analyses of Open Payments data also found similar variation among a limited number of surgical specialties,²⁴⁻²⁶ although a comprehensive analysis of medical and other specialties is absent. Certain specialties may have greater research and development involvement, resulting in royalty/license payments.²⁷ Comparisons between surgical, medical, and other specialties in these findings show distinct payment distributions and characteristics in each specialty type, with greater royalty/license

payments in surgical specialties compared with medical and other specialties. In addition, these findings are consistent with an analysis showing the broad extent of financial interaction between orthopedic surgery and industry,²⁶ a field with long-standing financial relationships²⁸ and a history of recent problematic relationships with device manufacturers influencing the dissemination of research results.^{27,29}

Whether transparency will impede valuable collaborations and the pace of innovation also requires ongoing evaluation, as does further investigation into the appropriateness of these financial relationships. For example, the influence of payments of greater value (orthopedic surgery received 80,951 payments [3%] by number and \$111 million of \$475 million [23%] by value) cannot necessarily be interpreted under the same criteria as payments to other specialties. However, the implications of these payments are complex, and the prevalence and magnitude of payments seen in these data increase the need for further research into the effect of these payments, both beneficial and problematic. Research has shown that physician payment laws may deter physician-industry relationships that create conflicts of interest.^{6,15} Physicians may be less likely to accept industry payments,¹⁵ and manufacturers may be less likely to pay physicians and shift these expenditures toward direct-to-consumer advertising and payers.³⁰ But there is also some debate as to whether an unintended consequence of transparency of physician payments may result in allowing such payments to be more rather than less influential because they have been disclosed³¹ due to discounting by informed patients or a feeling of moral license after having disclosed such a relationship. Moreover, others¹⁶ have found that the effects of transparency are small in deterring utilization of higher-priced drugs, for example. Many have expressed concern with the limitations of the Open Payments program, citing the inaccuracies of the database,³² the short review period,³³ and the value assigned to research payments due to the high price of drugs.³⁴ In addition, others are concerned that payment transparency, if not properly contextualized, will deter physicians from entering even those relationships that are beneficial out of concern that such payments will be misconstrued as problematic.³²

The present study adds to the current literature by providing a comprehensive analysis of

Open Payments physician-level data with specialty-specific analyses to evaluate differences in the distribution and characteristics of payments. Now that Open Payments data are publicly available, despite criticism of the data released thus far,³⁵ physicians must understand what is being reported, how to engage efficiently and effectively with Open Payments, and how to manage questions from patients and other interested parties. Manufacturers are not required to inform physicians that certain payments must be reported, and neither is physician participation in the program required; thus, educating physicians on transparency data is critical to physician awareness. The CMS estimates that 50% of physicians will have a reported financial relationship with industry.¹ We estimate that 40% of all allopathic and osteopathic physicians (324,523 of 813,123) received identified payments, nearly meeting the CMS estimates, although we expect that the actual proportion is greater. The remaining 1.7 million deidentified records may include up to 546,000 total physicians (68% of physicians by our estimates), but the actual number is unclear due to provider identifier inconsistencies.¹ The CMS also excluded 190,000 records due to delay in publication requests. In addition, manufacturers must now report payments for accredited continuing medical education activities made in 2016 and beyond. Moreover, if payers incorporate Open Payments data into certain quality and utilization measures used for reimbursement,¹⁴ more physicians are likely to review their reports. Acknowledging the potential for an increase in physicians engaging with Open Payments will ensure that the proper support and resources are available.

Although the CMS suggests that Open Payments data be combined with quality and utilization data to improve our understanding of these relationships,¹ no unique physician identifier is publicly available to facilitate comparison with other quality and utilization, research publication, or funding databases to facilitate effective analysis. Industry reporting of payments must include a National Provider Identifier; however, the law itself prohibits publication of National Provider Identifiers with Open Payments data. The CMS implemented a search tool to help identify payments by physician or manufacturer name but does not enable broader aggregation and analysis.

However, searching for payments to an individual physician still provides organizations the opportunity to verify conflicts of interest and make more informed decisions on physician participation in influential decision making and in developing guidelines. There is also ongoing debate about whether some payments deserve exclusion,³⁶ with recent federal efforts to allow payments related to accredited continuing medical education activities to be excluded from reporting requirements based on the recent changes made by the CMS discussed previously herein for the 2016 reporting year.

The extent to which patients' knowledge of industry-physician relationships will impact their decision making is unclear.³ Research into the opinions of patients regarding industry-physician financial conflicts of interest has shown that patients in clinical trials largely (90%) expressed little to no concern about the financial ties, although many wanted disclosure of these interests (31%).³⁷ In addition, a survey of orthopedic surgery patients found that they largely viewed financial relationships for surgeons acting as consultants for device manufacturers as beneficial.³⁸ Nevertheless, proper contextualization of payments is an ongoing concern for physicians and specialty societies given the potential for misinterpretation by patients or the media and the potential for use in liability claims. Industry collaborations in research are increasingly important as a result of stagnating government-funded support.^{28,29,39} In a commentary on the potential unintended effects of Open Payments on oncology care, one author suggests that given the assignment of industry publication expenses to a physician, important research findings may be delayed and researchers may be reluctant to engage in industry-supported research.⁴⁰ The present data establish important elements of payment context that may help to mitigate such reluctance, and ongoing assessment of the appropriateness of industry-physician relationships may help ensure that disclosure does not adversely affect beneficial relationships that are becoming more common and deters those that are inappropriate. Furthermore, such payments for publication expenses, if reported correctly, would be included in a research payment if subject to an agreement,

contract, or research protocol, and the separate reporting of research payments should mitigate certain concerns, especially as the program and reporting entity experience with the Open Payments system matures and physicians become more involved.

This study has limitations. First, it is limited by restricting the analysis to identified physician payments (payments linked to a physician with total confidence), excluding 1.7 million records. Accordingly, we likely underestimated the proportion of physicians receiving industry payments, and, as such, the generalizability of these data is limited. Also, we were unable to assess specialty-level systematic differences in the excluded data. However, the distribution of deidentified general payments by nature was similar to that of identified payments (Table 1), and we do not expect that errors leading to provider identification introduce large systematic bias, although it cannot be ruled out. Ongoing analyses of upcoming data releases will be an important step in verifying these findings and analyzing how they change over time. The CMS also excluded 190,000 records due to delay in publication requests, many of which may have been for proprietary drugs or devices. Accordingly, the incidence of physician payments may be underestimated, and we could not account for potential systematic differences in excluded records or inaccuracies inherent to the database. The CMS does not publish National Provider Identifiers in the public-use data set, so incorporation of demographic and other data of interest is limited.

The Open Payments data and these analyses, although important, demonstrate the need to test the effects of financial conflicts of interest on physician behavior and those of transparency itself in prospective interventional studies. In addition, the variability of these data between specialties demonstrates a potential need for specialty-specific advocacy as federal transparency programs and their broad availability evolve.

CONCLUSION

This analysis provides important insights into the specialty differences in industry-related conflicts of interest as the nation's physician workforce enters an era of transparency for

industry-physician relationships. These data can inform transparency policymaking and advocacy efforts by specialty organizations and guide further research efforts to measure the effect of transparency on physician and patient decision making and how industry-physician relationships change over time.

SUPPLEMENTAL ONLINE MATERIAL

Supplemental material can be found online at <http://www.mayoclinicproceedings.org>. Supplemental material attached to journal articles has not been edited, and the authors take responsibility for the accuracy of all data.

Abbreviations and Acronyms: CME = continuing medical education; CMS = Centers for Medicare and Medicaid Services; IQR = interquartile range; ROI = return on investment

Grant Support: The authors are partially supported by grants TL1TR00098 (D.C.M.), 5T35HL007491 (M.E.J.), UL1TR000100 (J.A.H.-G.), and KL2TR000099 (J.A.H.-G.) from the National Institutes of Health. The funder had no role in the design and conduct of the study; collection, management, analysis, and interpretation of the data; preparation, review, or approval of the manuscript; and decision to submit the manuscript for publication.

Potential Competing Interests: Dr Hattangadi-Gluth received a research grant from Varian Medical Systems, unrelated to the current study.

Correspondence: Address to Jona A. Hattangadi-Gluth, MD, Department of Radiation Medicine and Applied Sciences, Moores Cancer Center, University of California, San Diego, 3960 Health Sciences Dr, #0865, La Jolla, CA 92093-0843 (jhattangadi@ucsd.edu).

REFERENCES

- Centers for Medicare and Medicaid Services. Medicare, Medicaid, Children's Health Insurance Programs: transparency reports and reporting of physician ownership or investment interests: final rule. *Fed Regist*. 2013;78(27):9457-9528.
- Campbell EG, Rao SR, DesRoches CM, et al. Physician professionalism and changes in physician-industry relationships from 2004 to 2009. *Arch Intern Med*. 2010;170(20):1820-1826.
- Lo B, Field MJ, eds. *Conflict of Interest in Medical Research, Education, and Practice*. Washington, DC: National Academies Press; 2009.
- Wazana A. Physicians and the pharmaceutical industry: is a gift ever just a gift? *JAMA*. 2000;283(3):373-380.
- Dana J, Loewenstein G. A social science perspective on gifts to physicians from industry. *JAMA*. 2003;290(2):252-255.
- Chimonas S, Rozario NM, Rothman DJ. Show us the money: lessons in transparency from state pharmaceutical marketing disclosure laws. *Health Serv Res*. 2010;45(1):98-114.
- Department of Health and Human Services (DHHS), Office of the Inspector General. OIG compliance program guidelines for pharmaceutical manufacturers. *Fed Regist*. 2003;68:23731.
- Hwong AR, Qaragholi N, Carpenter D, Joffe S, Campbell EG, Soleymani Lehmann L. A systematic review of state and manufacturer physician payment disclosure websites: implications for implementation of the Sunshine Act. *J Law Med Ethics*. 2014;42(2):208-219.
- Kesselheim AS, Robertson CT, Siri K, Batra P, Franklin JM. Distributions of industry payments to Massachusetts physicians. *N Engl J Med*. 2013;368(22):2049-2052.
- Drug Company Gift Disclosure Act of 2002, HR 5037, 107th Cong, 2nd Sess (2002).
- Physician Payments Sunshine Act of 2007, S 2029, 110th Cong, 1st Sess (2007).
- Physician Payments Sunshine Act of 2009, S 301, 111th Cong, 1st Sess (2009).
- Patient Protection and Affordable Care Act, Public Law 111-148, USC HR 3590 (2010).
- Rosenthal MB, Mello MM. Sunlight as disinfectant: new rules on disclosure of industry payments to physicians. *N Engl J Med*. 2013;368(22):2052-2054.
- Sah S, Loewenstein G. Nothing to declare: mandatory and voluntary disclosure leads advisors to avoid conflicts of interest. *Psychol Sci*. 2014;25(2):575-584.
- Pham-Kanter G, Alexander GC, Nair K. Effect of physician payment disclosure laws on prescribing. *Arch Intern Med*. 2012;172(10):819-821.
- Division of Survey and Data Resources, American Medical Association. *Physician Characteristics and Distribution in the United States*. Chicago, IL: American Medical Association; 2013.
- Frequently asked questions (FAQ 8376). Centers for Medicare and Medicaid Services website. <https://questions.cms.gov/faq.php?id=5005&faqId=8376>. Accessed June 15, 2015.
- Dollars for Docs: Open Payments explorer: how much industry money goes to doctors and teaching hospitals. ProPublica website. <http://projects.propublica.org/open-payments>. Accessed February 1, 2015.
- Jarvis D, Coombes R, Stahl-Timmins W. Open Payments goes live with pharma to doctor-fee data: first analysis. *BMJ*. 2014;349:g6003.
- Department of Health and Human Services, Centers for Medicare and Medicaid Services. *Annual Report to Congress on the Open Payments Program for Fiscal Year 2014*. Baltimore, MD: Centers for Medicare and Medicaid Services; 2015.
- Dollars for Docs: How industry dollars reach your doctors. ProPublica website. <https://projects.propublica.org/docdollars>. Accessed June 15, 2015.
- Campbell EG, Gruen RL, Mountford J, Miller LG, Cleary PD, Blumenthal D. A national survey of physician-industry relationships. *N Engl J Med*. 2007;356(17):1742-1750.
- Chang JS. The Physician Payments Sunshine Act: data evaluation regarding payments to ophthalmologists. *Ophthalmology*. 2015;122(4):656-661.
- Rathi VK, Samuel AM, Mehra S. Industry ties in otolaryngology: initial insights from the physician payment sunshine act. *Otolaryngol Head Neck Surg*. 2015;152(6):993-999.
- Samuel AM, Webb ML, Lukasiewicz AM, et al. Orthopaedic surgeons receive the most industry payments to physicians but large disparities are seen in Sunshine Act data. *Clin Orthop Relat Res*. 2015;473(10):3297-3306.
- Chatterji AK, Fabrizio KR, Mitchell W, Schulman KA. Physician-industry cooperation in the medical device industry. *Health Aff (Millwood)*. 2008;27(6):1532-1543.
- Zuckerman JD, Prasam M, Kubiak EN, Koval KJ. Conflict of interest in orthopaedic research. *J Bone Joint Surg Am*. 2004;86(2):423-428.
- Gelberman RH, Samson D, Mirza SK, Callaghan JJ, Pellegrini VD Jr. Orthopaedic surgeons and the medical device industry: the threat to scientific integrity and the public trust. *J Bone Joint Surg Am*. 2010;92(3):765-777.
- Mackey TK, Liang BA. Physician payment disclosure under health care reform: will the sun shine? *J Am Board Fam Med*. 2013;26(3):327-331.

31. Loewenstein G, Sah S, Cain DM. The unintended consequences of conflict of interest disclosure. *JAMA*. 2012;307(7):669-670.
32. Moy B, Jagsi R, Gaynor RB, Ratain MJ. The impact of industry on oncology research and practice. *Am Soc Clin Oncol Educ Book*. 2015;35:130-137.
33. Kirschner NM, Sulmasy LS, Kesselheim AS. Health policy basics: the Physician Payment Sunshine Act and the Open Payments program. *Ann Intern Med*. 2014;161(7):519-521.
34. Morain SR, Flexner C, Kass NE, Sugarman J. Forecast for the Physician Payment Sunshine Act: partly to mostly cloudy? *Ann Intern Med*. 2014;161(12):915-916.
35. Santhakumar S, Adashi EY. The Physician Payment Sunshine Act: testing the value of transparency. *JAMA*. 2015;313(1):23-24.
36. Richardson EC, A, Saver R, Lott R, Gnadinger T. Health Policy Brief: The Physician Payments Sunshine Act," *Health Affairs*. October 2, 2014.
37. Hampson LA, Agrawal M, Joffe S, Gross CP, Verter J, Emanuel EJ. Patients' views on financial conflicts of interest in cancer research trials. *N Engl J Med*. 2006;355(22):2330-2337.
38. Khan MH, Lee JY, Rihn JA, et al. The surgeon as a consultant for medical device manufacturers: what do our patients think? *Spine (Phila Pa 1976)*. 2007;32(23):2616-2618; discussion 2619.
39. Moses H III, Matheson DH, Cairns-Smith S, George BP, Palisch C, Dorsey ER. The anatomy of medical research: US and international comparisons. *JAMA*. 2015;313(2):174-189.
40. Ratain MJ. Forecasting unanticipated consequences of "The Sunshine Act": mostly cloudy. *J Clin Oncol*. 2014;32(22):2293-2295.