

Medical Device Companies and Doctors: Do their interactions affect medical treatments?

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Interactions physicians-industry: contentious issue in healthcare

Physicians interact frequently with the industry

Might be beneficial:



- Provides information about new drugs & medical devices.
- Improves patients' outcomes.
- Advances science and technology.

Might be harmful:



- Creates conflict of interest.
- Biases healthcare providers.
- Adversely affects patient outcomes.
- Increases healthcare resources in a wasteful way.

Summary

Research question:

Do interactions between the medical device industry and physicians influence treatments provided to heart attack patients?

Which "treatments" are considered?

- Drugs
- Medical procedures

Which interactions?

Those that resulted in payments (Open Payments, Centers for Medicare & Medicaid Services)

Generally, it is not obvious that one treatment option is clearly better than the other.

Methodology and results:

- Instrumental variables approach to account for endogeneity of payments.
- Physicians who interact often with the medical device industry are more likely to perform an invasive procedure to a heart attack patient than a never-paid physician.
- No significant impact on health care outcomes.
- Slightly higher health care costs.

Initiatives to increase transparency

Affordable Care Act:

- Payments made from pharmaceutical companies and medical device companies to physicians are now disclosed in the US.
- According to the new healthcare law, any payment or transfer value higher than \$10 individually or higher than \$100 per year must be annually reported.

Related Literature and contribution

Interactions pharma-physicians

- Payments tend to ↑ prescriptions (Carey et al. 2020; Chatterji et al. 2018; Engelberg et al. 2014).
- Pharma promotion ↑ opioid prescriptions; which in turn ↑ opioid overdose rates (Fernandez & Zejcirovicy 2019). Physicians overprescribe less due to the secondary market (Schnell, 2017). For opioids in France: Natali et al. (2019)

Physicians' incentives (in particular, financial incentives)

- Physicians tend to increase the rate of procedures when treatment is profitable and reduce it when is costly (McGuire 2000).
- Cesarean rates (Grant 2009; Gruber & Owings 1996; Shurtz 2014).

Not much is known about possible impacts of industry-doctors interactions on medical treatments, in particular those related to medical device companies.

Medical Device Industry

Is a relevant industry: total of \$172 billion spending in medical devices in 2013, corresponding to 6% of total national health expenditures

We know little about the medical device industry, with a few exceptions (Stern 2017; Mojir & Sudhir 2017; Grennan 2013; Grennan & Town, 2019).

The pharma and the medical device industries work differently:

- direct-to-consumer advertisement in pharma;
- patients can have a role in choosing their drugs (e.g., branded vs generic);
- doctors can easily try new drugs on patients;
- doctors do not tend to discuss with their patients the type of medical devices used during surgery;
- medical devices might require training.

Setting: Acute myocardial infarction (AMI) - Heart attack

More than 700,000 Americans have an AMI every year.

Typically occurs when a blood clot blocks the blood inflow to the heart.

It is a medical emergency that requires treatment to restore blood flow.

The longer the time without treatment, the greater the damage to the heart muscle can occur.

AMI was the top 5 most expensive condition to treat in US hospitals in 2011, accounting for 3% of national costs (Torio & Andrews 2013)

Setting: Acute myocardial infarction (AMI) - Heart attack

When a heart attack patient arrives at the emergency room, a quick decision about the treatment must be made:

- Treatment with drugs (thrombolytic clot-busting drugs)
- Treatment with medical intervention / revascularization techniques

Hospital:

Florida Hospital Inpatient Discharge Data to identify heart attack patients in Florida from 2013 until 2015.

Analysis restricted to patients who were admitted through the Emergency Room (ER) in order to avoid possible physician selection.

Information at the patient level (age, type of insurance, ethnicity, gender, length of stay).

Diagnosis and procedure codes: type of treatment, discharge status, comorbidities and risk factors.

Payments:

Open Payments dataset from the Centers for Medicaid and Medicare.

Type of payment: meals, travel, speaking fees, honoraria, gifts, or research.

Analysis restricted to payments related to medical devices; additionally, only payments related to cardiac interventional treatments are considered.

Hospitals' discharge data and payments data together:

Physician ID is not the same

(Conservative) matching algorithm to recover physicians' National Provider Identifier (NPI)

Higher matching rate than commonly found

Also include additional data on physicians' characteristics and hospitals' cost-to-charge ratios (CCR) to convert hospital charges into costs.

Desc: Patients' characteristics

Variable	Mean	SD
Invasive	0.62	48.5
Discharged home	0.66	47.33
Died in hospital	0.07	26.11
Length of stay-days	5.83	7.7
Patient age	69.55	14.14
Charlson Index	2.7	2.11
Male patient	0.6	0.49
White patient	0.82	0.39
Black patient	0.11	0.32
Congestive Heart	0.32	0.47
Peripheral Vascular disease	0.09	0.29
Cerebrovascular disease	0.07	0.26
Chronic Obstructive Pulmonary	0.23	0.42
Mild LD (Liver)	0.01	0.1
Diabetes	0.29	0.45
HP/PAPL (Hemiplegia or Paraplegia)	0.01	0.1
Cancer	0.04	0.19
Metastatic Cancer	0.01	0.12
Medicare	0.66	0.47
Medicaid	0.06	0.25
N	117,485	

Desc: Physicians' characteristics

Variable	Mean	SD
All physicians		
N		4215
Top 20 Medical School	0.03	0.18
Spanish	0.21	0.4
Years since graduation	20.39	10.86
Male doc	0.77	0.42

Desc: Payments (Paid Physicians only)

Variable	Mean	SD	Max
Av Doc Pay (\$)	99	234	7500
Total Doc Pay (\$)	603	2208	48426
Frequency of quarters paid	3.04	2.45	9
N		1044	

Desc: Healthcare costs

Variable	Mean (\$)	SD
Cardio Costs	5771	5685
Medical Dev Costs	2460	4093
Operating Room Costs	1494	4653
Total Gross Costs	23,427	23,593

Empirical Approach

In a situation in which there would be random assignment of payments and hospital practice behavior, one could estimate a simple empirical model:

$$Y_{ijht} = \alpha_1 + \alpha_2 AvDocPay_{j,t-1} + \alpha_3 P_{jt} + \alpha_4 X_{it} + \alpha_5 Hospital_h \times Time_t + \epsilon_{ijht}$$

AvDocPay: physician's average payment for cardiac devices

P: Physicians characteristics

X: Patients characteristics

Outcomes:

- Medical procedure - Probability of invasive procedure.
- Health care outcomes - Died in hospital, discharged home, length of stay.
- Costs - cardiology, medical devices, operating room, and total hospital costs.

Key challenges to estimate this equation:

AvDocPay may still be correlated with unobserved physician variables that could affect the likelihood of performing an invasive procedure.

Empirical Approach: IV

The first-stage regression is the following:

$$AvDocPay_{jt} = \beta_0 + \beta_1 AvHospPay_{-jt} + \beta_2 AvHospPay_{-jt}^2 + \beta_3 P_{jt} + \beta_4 X_{it} + \beta_5 Hospital_h \times Time_t + u_{ijt}$$

The average physician payment depends on the leave-out average payment at the hospital where the physician practices, excluding the physician's own payments.

Medical procedures and healthcare outcomes

Dep. var:	Invasive AvDocPay		Invasive		Died		Discharged Home		Length of Stay	
	OLS (1)	IV 1st (2)	IV 2nd (3)	OLS (4)	IV 2nd (5)	OLS (6)	IV 2nd (7)	OLS (8)	IV 2nd (9)	
AvDocPay	0.023*** (0.005)		0.017*** (0.005)	-0.000 (0.001)	0.001 (0.002)	0.006*** (0.002)	0.003 (0.005)	0.000 (0.000)	0.000 (0.000)	
AvHospPay		-0.223*** (0.022)								
AvHospPaySq		0.000*** (0.000)								
Patient charac	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Physician charac	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
HospXTime FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
F-test			54.163		54.163		51.121		54.163	
R ²	0.253		0.201	0.037	0.022	0.186	0.138	0.181	0.138	
Observations	117485	117481	117481	117485	117481	108858	108852	117485	117481	

Notes: The dependent variable *invasive* is 100 if an invasive procedure was performed and zero otherwise; similar to the dependent variables *died* and *discharged home*. *Length of stay* is the log of days spent at the hospital. The variable *AvDocPay* is the average dollar payment related to cardiac devices that the physician received in the previous quarter. Standard errors are clustered at the hospital-time level.

Types of Costs

Dep. var:	Cardiology		Med Device		Operating Room		Total	
	OLS (1)	IV 2nd (2)	OLS (3)	IV 2nd (4)	OLS (5)	IV 2nd (6)	OLS (7)	IV 2nd (8)
AvDocPay	0.531** (0.243)	0.222 (0.597)	2.806*** (0.682)	4.039*** (1.322)	2.568*** (0.647)	0.682 (0.824)	9.956*** (2.311)	6.252** (2.654)
Patient characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Physician characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HospitalxTime FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.562	0.495	0.192	0.087	0.087	0.026	0.159	0.073
Observations	117343	117339	117343	117339	117343	117339	117343	117339

Note: Costs variables are in dollars. The variable *AvDocPay* is the average dollar payment related to cardiac devices that the physician received in the previous quarter. Standard errors are clustered at the hospital-time level.

Invasive according to appropriateness

Dep. var:	Invasive		
	Low Appropriateness (1)	Middle Appropriateness (2)	High Appropriateness (3)
AvDocPay	0.056*** (0.016)	0.026** (0.011)	0.009** (0.004)
Patient characteristics	Yes	Yes	Yes
Doctor characteristics	Yes	Yes	Yes
Hospital x Time FE	Yes	Yes	Yes
F-test	22.908	28.723	43.235
R ²	0.075	0.024	0.028
Observations	37468	39946	40009

Notes: The variable *AvDocPay* is the average dollar payment related to cardiac devices that the physician received in the previous quarter. Standard errors are clustered at the hospital-time level.

Heterogeneities: Type of hospital

	OLS	IV 1st	IV 2nd	OLS	IV 1st	IV 2nd
Dep. var:	Investment Owned			Not-For-Profit Urban		
	Invasive (1)	AvDocPay (2)	Invasive (3)	Invasive (4)	AvDocPay (5)	Invasive (6)
AvDocPay	0.022*** (0.007)		0.027** (0.012)	0.022*** (0.006)		0.014*** (0.005)
AvHospPay		-0.206*** (0.035)			-0.233*** (0.026)	
AvHospPaySq		0.000*** (0.000)			0.000*** (0.000)	
Patient characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Doctor characteristics	Yes	Yes	Yes	Yes	Yes	Yes
HospitalxTime FE	Yes	Yes	Yes	Yes	Yes	Yes
F-test			20.107			39.490
R ²	0.248		0.192	0.258		0.207
Observations	47505	47505	47505	69560	69556	69556

Note: Standard errors are clustered at the hospital-time level.

Conclusions

- Interactions between the cardiac device industry and physicians is associated with a higher likelihood of performing an intervention in heart attack patients (3% higher).
- There seems to be some heterogeneity effects.
- Physicians receiving this type of payments tend to be frequently receivers.
- No significant impact on healthcare outcomes.
- Costs seem to be higher for patients treated by physicians who interact with the industry (16% higher for medical devices, 3% higher for total hospital costs).

Conclusions

- Interactions with the medical device industry can affect medical treatments.
- High degree of new medical technologies in the market.
- Malpractice pressure also plays a role in preventing physicians from providing harmful treatments to patients.
- Regulations between industry-physicians must be carefully designed (e.g., disclosure does not prevent possible influences on physicians).

Thank you!