Alternatives to Opioids Prescribing Ratio Across States:
Provider and Beneficiary Characteristics

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BACKGROUND

The path to opioid addiction often begins with doctor's legal prescription of painkillers. To curb opioid over prescription, some health care providers are returning to alternatives to opiates (ALTOs) such as Acetaminophen, Gabapentin and many nonsteroidal anti-inflammatory drugs as safe alternatives for alleviating pain.

OBJECTIVES

We study the role of physician characteristics (race, gender, specialty, and rural/urban location) and beneficiary characteristics (race, gender, age, dual status, and health risk score) in determining the prescription of ALTOs. We consider the interaction between the race (and gender) of the physician and that of his/her patients and investigate whether treating patients more similar to oneself increases the likelihood of prescribing ALTOs.

METHODS

We combine Medicare Part D Prescriber Public Use File from years 2013 to 2016. The PUF defines whether a drug is an opioid; Exhibit 1 shows the generic drug names of opioids. We define the ALTOs based on the generic names shown in Exhibit 2.

The PUF does not provide the race/ethnicity of the prescriber. We predict the race/ethnicity from the prescriber's first and last name using a machine learning algorithm trained from the Florida Voter Registration data (python package "ethnicolr") based on a model of the relationship between the sequence of characters in a name and race and ethnicity (Sood and Laohaprapanon, 2018). We define the urban status using the ZIP code Rural-Urban Commuting Areas (RUCA 3.0) geographic taxonomy.

We estimate an OLS model specified as follows:

$$y_{p,t} = \beta_0 + \beta^w W + \beta^x X + \beta_1 \, White\ Doctor_p \times Prop\ White\ Patients_{p,t} + \beta_2 \, Male\ Doctor_p \times Prop\ Male\ Patients_{p,t} + \beta^s S + \beta^t T + \epsilon$$

where p denotes each prescriber (NPI) and t denotes year. We define three outcomes of interest ($y_{p,t}$):

- Number of claims for ALTOs as a fraction of the sum of ALTOs- and opioids- related claims (claims ratio hereafter): # ALTOSs claims / (# ATOSs claims + # Opioid claims)
- Number of beneficiaries filling ALTOs prescription as a fraction of the sum of people with both ALTOs- and opioid- claims (bene ratio hereafter): # ATOSs bene / (# ATOSs bene + # Opioid bene)
- Cost of claims for ALTOs as a fraction of the total costs of ALTOs- and opioids- claims (costs ratio hereafter): ATOSs costs / (ATOSs costs + Opioid costs)

The vector W includes prescriber characteristics such as gender, race, location (urban, large rural/town, small rural/town, and isolated small rural/town; urban is the omitted category), and specialty. The vector X denotes characteristics of the prescriber's patients, such as the proportion of patients who are male, White, younger than 65, and dual-eligible, and the patients' average health risk score. The patient characteristics vary by year for each prescriber. The vector S denotes the state-fixed effects. The vector T includes year dummies and 2013 is the omitted year. β_1 and β_2 are the parameters of interest.

EXHIBIT 1 DEFINITION FOR OPIOIDS

ACETAMINOPHEN WITH CODEINE	HYDROCODONE BITARTRATE	OPIUM/BELLADONNA ALKALOIDS
ACETAMINOPHEN/CAFF/DIHYDROCOD	HYDROCODONE/ACETAMINOPHEN	OXYCODONE HCL
ASPIRIN/CAFFEIN/DIHYDROCODEINE	HYDROCODONE/IBUPROFEN	OXYCODONE HCL/ACETAMINOPHEN
BUPRENORPHINE	HYDROMORPHONE HCL	OXYCODONE HCL/ASPIRIN
BUPRENORPHINE HCL	HYDROMORPHONE HCL/PF	OXYCODONE HCL/OXYCODON TER/ASA
BUTALBIT/ACETAMIN/CAFF/CODEINE	IBUPROFEN/OXYCODONE HCL	OXYCODONE MYRISTATE
BUTORPHANOL TARTRATE	LEVORPHANOL TARTRATE	OXYMORPHONE HCL
CARISOPRODOL/ASPIRIN/CODEINE	MEPERIDINE HCL	PENTAZOCINE HCL/ACETAMINOPHEN
CODEINE SULFATE	MEPERIDINE HCL/PF	PENTAZOCINE HCL/NALOXONE HCL
CODEINE/BUTALBITAL/ASA/CAFFEIN	METHADONE HCL	PENTAZOCINE LACTATE
CODEINE/CARISOPRODOL/ASPIRIN	MORPHINE SULFATE	TAPENTADOL HCL
DHCODEINE BT/ACETAMINOPHN/CAFF	MORPHINE SULFATE/NALTREXONE	TRAMADOL HCL
DIHYDROCODEINE/ASPIRIN/CAFFEIN	MORPHINE SULFATE/PF	TRAMADOL HCL/ACETAMINOPHEN
FENTANYL	NALBUPHINE HCL	
FENTANYL CITRATE	OPIUM TINCTURE	

EXHIBIT 2 DEFINITION FOR ALTOS

ACETAMINOPHEN	DICLOFENAC	KETAMINE	PROPOFOL
ANAPROX	DIPRIVAN	KETOROLAC	ROPIVACAINE
CYCLOBENZAPRINE	GABAPENTIN	LIDOCAINE	SUMATRIPTAN
DEXAMETHASONE	HALOPERIDOL	METOCLOPRAMIDE	
DIAZEPAM	IBUPROFEN	NAPROXEN	

DESCRIPTIVE FINDINGS

Exhibit 3 shows the scatter plots of the 2013 and 2016 state-level ALTOs claims ratios and costs ratios, respectively.

- For ALTOs claims ratios, all states experienced an increase during 2013 and 2016, and several states, such as RI, MA, WV, DE, OH, and MD, performed exceptionally well.
- However, for ALTOs costs ratios, the majority of states experienced a decrease during 2013 and 2016, probably due to the increase in the price of opioid during the same period. Several states performed particularly better than the rest, such as RI, TX, DE, and MD. Several states performed particularly worse than the rest, such as WY, SD, KS, WA, and UT.

Exhibit 4 shows the mean and the 95 percent CI of the state-level ALTOs claims ratios in each specialty in 2016. Across the three outcomes, there exists variation in the ALTOs ratios across states within each specialty.

- Specialties such as Psychiatry/Neurology and Ophthalmology/Optometry have the highest ALTOs rates.
- Specialties such as Urology, Emergency Medicine, Oral Surgery, Cardiology, and Surgery have the lowest ALTOs rates.

EXHIBIT 3A STATE LEVEL ALTOS CLAIMS RATIO IN 2013 AND 2016

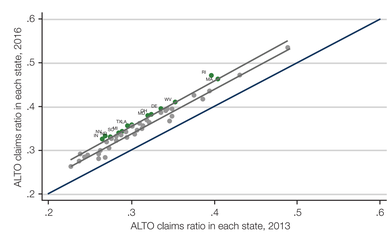
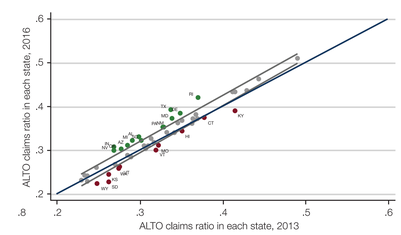


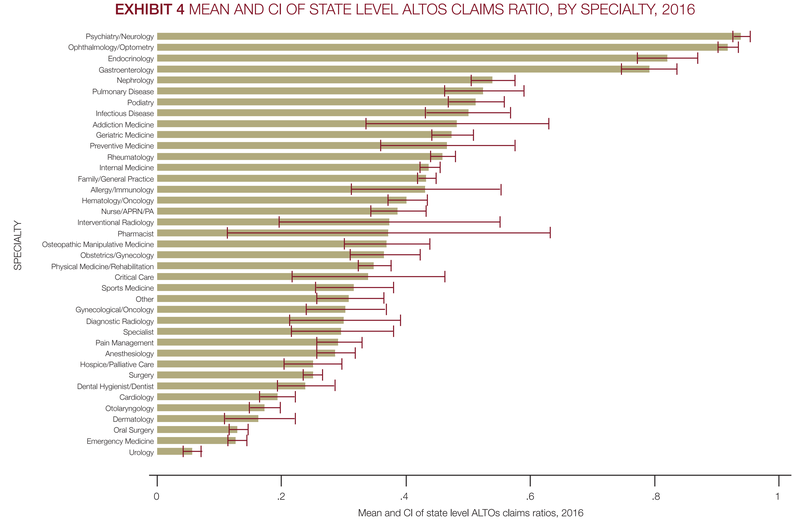
EXHIBIT 3B STATE LEVEL ALTOS COSTS RATIO IN 2013 AND 2016



45 degree line — 95% CI
Below CI and the 45 degree line — Above CI and the 45 degree line
Other

Notes: The blue line is the 45-degree line, and a dot above (below) the 45-degree line indicates that the state experienced an increase (a decrease) from 2013 to 2016. The gray lines indicate the 95 percent confidence interval (CI) of the 2016 rates predicted from the linear model. The green (red) color shows that the dot is above (below) the CI lines and the 45-degree line, i.e., the state experienced an increase (a decrease) in from 2013 to 2016 and performed better (worse) than the average across states.

EXHIBIT 4 MEAN AND CI OF STATE LEVEL ALTOS CLAIMS RATIO, BY SPECIALTY, 2016



REGRESSION RESULTS

Exhibit 5 shows the regression results of our preferred model for the three outcomes. We include the male doctor by specialty fixed effects to account for the selection in gender across specialty. We find that across all outcomes, ALTOs prescription ratios are higher if the prescriber has a higher likelihood of treating patients of the same gender, and if the prescriber has a higher likelihood of treating patients of the same race.

- For doctors with an average proportion (39.5%) of male beneficiaries, being a male doctor increases
  - the ALTOs claims ratio by 8.77 percentage points, which is a 24.4% increase relative to the mean (mean claims ratio is 36%)
  - the ALTOs bene ratio by 5.89 percentage points, which is a 17.7% increase relative to the mean (mean bene ratio is 33.3%)
  - the ALTOs costs ratio by 6.16 percentage points, which is a 17.3% increase relative to the mean (mean costs ratio is 35.6%)
- For doctors with an average proportion (76.3%) of White beneficiaries, being a White doctor increases
  - the ALTOs claims ratio by 2.82 percentage points, which is a 7.8% increase relative to the mean
  - the ALTOs bene ratio by 3.20 percentage points, which is an 9.6% increase relative to the mean
  - the ALTOs costs ratio by 4.04 percentage points, which is a 11.4% increase relative to the mean

Across all outcomes, ALTOs ratios are higher if the prescriber has a higher proportion of beneficiaries who are dual-eligible, older than 65, and having a lower health-risk score.

EXHIBIT 5 PROVIDER AND BENEFICIARY CHARACTERISTICS AND ALTOS PRESCRIPTION RATIOS, 2013-2016

VARIABLES	(1) bene ratio	(2) claims ratio	(3) costs ratio
Male doctor	-0.177	-0.098	-0.062
	(0.186)	(0.142)	(0.141)
Bene male prop.	-0.026	-0.107***	-0.139***
	(0.023)	(0.019)	(0.020)
Male doctor X Bene male prop.	0.149***	0.222***	0.156***
	(0.027)	(0.025)	(0.029)
White doctor	-0.052***	-0.045***	-0.069***
	(0.009)	(0.010)	(0.010)
Bene White prop.	-0.180***	-0.148***	-0.188***
	(0.020)	(0.022)	(0.017)
White doctor X Bene White prop.	0.042***	0.037***	0.053***
	(0.011)	(0.011)	(0.011)
Large rural/town^	-0.003	-0.001	-0.011**
	(0.004)	(0.004)	(0.005)
Small rural/town^	-0.014**	-0.004	-0.023***
	(0.007)	(0.006)	(0.008)
Isolated small rural/town^	-0.014	0.005	-0.018*
	(0.009)	(0.007)	(0.010)
Bene dual-eligible prop.	0.264***	0.278***	0.341***
	(0.036)	(0.035)	(0.034)
Bene <65 prop.	-0.140***	-0.226***	-0.352***
	(0.050)	(0.045)	(0.050)
Bene avg. risk score	-0.089***	-0.083***	-0.093***
	(0.004)	(0.005)	(0.006)
2014	0.009***	0.010***	-0.015***
	(0.001)	(0.001)	(0.002)
2015	0.041***	0.040***	-0.001
	(0.002)	(0.002)	(0.004)
2016	0.065***	0.056***	0.018***
	(0.002)	(0.002)	(0.004)
State Fixed Effects	Y	Y	Y
Specialty Fixed Effects	Y	Y	Y
Male doctor by specialty Fixed Effects	Y	Y	Y
Constant	0.731***	0.671***	0.662***
	(0.165)	(0.134)	(0.136)
Observations	762,310	762,310	762,310
R-squared	0.339	0.385	0.345

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. ^: The reference category is Urban. 2013 is the reference year.

CONCLUSIONS

- Comparing 2016 to 2013, all states have experienced a systematic increase in the ALTOs claims ratios and the percentage of beneficiaries reached, however, eighteen states experienced a systematic decrease and 33 states increase in the relative amount spent on ALTOs compared to opioids.
- ALTOs prescription ratios are higher if the prescriber has a higher likelihood of treating patients of the same gender, and if the prescriber has a higher likelihood of treating patients of the same race.
- Although disparities in pain management along prescriber and patient characteristics should not determine the quality of care, our findings suggest the opposite. Policymakers should create guidelines and policies that reflect the characteristics of the population to address the opioid epidemic.