Are We Fighting the Right War? Estimating the Effect of Prescription Drug Supply-Side Interventions

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1 Extended Abstract

Can supply reduction interventions effectively halt prescription drug abuse? This question is important for policy as prescription drug abuse is America's fastest-growing drug problem. According to the 2012 National Survey on Drug Use and Health, 2.6% of persons aged 12 or older in the U.S. were past month illicit users of prescription drugs, a higher prevalence rate than that of any other illicit drug, excluding marijuana. Overdose deaths from opioid pain relievers, the most commonly abused prescription drug, increased by 313% from 4,030 in 1999 to 16,651 in 2010 (CDC, 2013). These deaths now exceed those involving heroin and cocaine combined. The abuse of opioid pain relievers imposes considerable societal costs. Birnbaum et al. (2011) estimate that in 2007 these costs amounted to $55.7 billion, out of which 46%, 45% and 9% were attributable to workplace, health care and criminal justice costs, respectively.

Government intervention targets drug abuse in three critical ways: prevention, treatment and law enforcement. Prevention and treatment are demand-side interventions, with the former consisting of community-based educational programs as to deter new users and the latter consisting of recovery support programs to deter existing users (Dobkin & Nicosia, 2009; National Drug Control Strategy, 2010). Law enforcement largely engages in supply-side activities where a main goal is to reduce drug availability. This study uses novel data to estimate the effect of prescription drug supply reduction interventions on price, quantities, public health, user responses and healthcare provider responses. Public health is measured by opioid related deaths, hospital discharges and substance abuse treatment admissions; user responses are measured by consumption of substitute and complement drugs; and healthcare provider responses are measured by pharmacy openings.[1] By employing time-discontinuity and difference-in-differences approaches, this paper exploits a quasi-experimental setting in which enforcement and legislative initiatives caused a substantial shock to opioid pain reliever supply in Florida.

Florida became the epicenter of the Nation's prescription drug abuse epidemic,[2] and Oxycodone, the painkiller on demand[3]. In 2009, the average purchase of Oxycodone products for all U.S. pharmacies was 63,294 dosage units, meanwhile, among Florida's top 100 pharmacies selling Oxycodone this figure was 1,226,460. Furthermore, of the top 50 practitioners dispensing Oxycodone in the U.S. during the period of October 2008 to March 2009, all but one were located in Florida. Although more careful study is needed to understand the reasons as to why abuse escalated in Florida, some argue that the driving forces were the absence of a prescription drug monitoring program (PDMP) and the proliferation of pain management clinics, where inappropriate prescribing and dispensing of Oxycodone and other prescription drugs took place. In an effort to halt abuse, three main interventions were implemented: 1) the Drug Enforcement Administration's Operation Pill Nation, which consisted of a sweeping takedown of rogue pain clinics. Other enforcement activities targeted wholesale distributors, physicians and pharmacies by revoking their DEA registrations; 2) the enactment of more stringent dispensing practitioner laws, which occurred in two stages, and concluded with the prohibition of physicians dispensing of schedule II-III controlled substances[4] and 3) the implementation of the Prescription Drug Monitoring Program, an electronic database that tracks substances dispensed in the state. These interventions successfully caused a negative shock to supply, with dispensing physicians[5] being significantly affected as shown in Figure 1[6].

This research advances the literature in several ways. First, by exploiting a substantial shock to supply in Florida, where the market of opioid painkillers was highly concentrated[7], one can credibly measure the effectiveness of tighter regulations. This design overcomes various difficulties faced by previous studies trying to measure the impact of supply-

[1] Dispensing practitioner laws eliminated competition by forbidding doctors from dispensing drugs. This implied that only pharmacies were allowed to dispense certain controlled substances. Anecdotal evidence suggests that as a result, pharmacy applications skyrocketed in the state of Florida.

[2] According to DEA reports, Florida was a major source of prescription drugs for people from other states, especially Georgia, Kentucky, Ohio and Tennessee.

[3] According to ARCOS' data, in 2009, a total of 15,574,833 grams of Buprenorphine, Codeine, Fentanyl, Hydrocodone, Hydromorphone, Methadone, Morphine, Oxycodone and Oxymorphone, the most abused narcotics, were distributed to Florida healthcare providers. Of this total, Oxycodone represented 61%.

[4] Controlled substances, as defined under the 1970 Controlled Substances Act are divided into five schedules. The classification is based on whether they have a currently accepted medical use in treatment in the United States, their relative abuse potential, and likelihood of causing dependence when abused (DEA's Office of Diversion Control). Examples of controlled substances in schedules I, II, III, and IV are heroin, oxycodone, buprenorphine and alprazolam, respectively.

[5] According to ARCOS, in 2009 roughly 11% of all Oxycodone in Florida was being distributed to dispensing physicians

[6] This graph was retrieved from the Drug Enforcement Administration's report *Prescription Drug Trafficking Trends, Synthetic Drugs and Methamphetamine* Note that it does not include sales to pharmacies or hospitals.

[7] See footnote 3

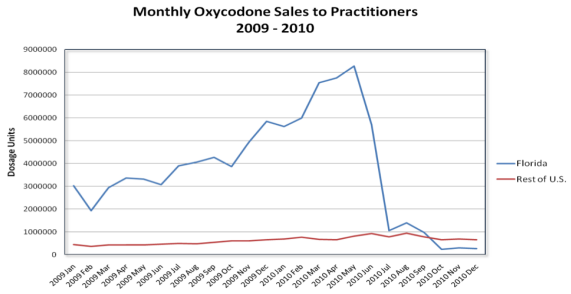


Figure 1: Monthly Oxycodone Sales to Practitioners

side interventions, as in most cases, interventions fail to create a substantial supply shock[8]. Second, prescription drugs imply the existence of drug sales/consumption data. This piece of evidence is incorporated by making use of data from Medicaid's Drug Utilization Reports and DEA's Automation of Reports and Consolidated Orders System (ARCOS). This is an improvement from previous studies on illegal drugs, where data on supply or demand of illicit drugs are difficult, if not impossible to obtain, and thus must rely on hospital discharges or drug seizures. Third, data on overdose deaths by drug type allow for a closer examination of substitute and complement drugs[9]. Fourth, this setting may foreshadow potential threats and benefits of re-scheduling or legalizing controlled substances. Fifth, this study is one of the first, if not the first, to causally[10] assess the effectiveness of supply-side strategies on halting abuse of *legally* supplied controlled substances. Previous literature has almost strictly focused on illicit drug supply-side interventions (Caulkins & Yuan, 1998; Dobkin & Nicosia, 2009). These results, however, may not generalize to prescription drugs. Although illicit and prescription drugs are alike in that they can act on the same brain sites, unlike illicit drugs, prescription drugs have accepted medical use in treatment, and thus, are legally produced and provided. This important distinction implies further differences between illegally and legally produced drugs, which in turn, may be reflected in study results. These differences take various forms: (1) alternatives to address drug abuse -e.g. Prescription Drug Monitoring Programs- (2) affected populations -e.g. legitimate vs. illegitimate users- (3) suppliers -e.g. medical practitioners vs. street dealers- (4) ease of access, and (5) perceived use risk. The main limitation of this study is it's inability to estimate the individual effect of each intervention in the absence of the others.[11].

Preliminary findings suggest that tighter regulations resulted in a substantial negative shock to the supply of Oxycodone and other painkillers. There is no evidence of a supply recovery. The trend break in Oxycodone supply consisted of both, an instantaneous reduction of 17% from Q2 to Q3 of 2010, and a long-run reduction of 73% from Q2 of 2010 to Q4 of 2013. The reduction was accompanied by a 200% increase in Oxycodone street prices and a 55% decline in monthly deaths with a mention of Oxycodone. Similar downward trends are observed for Alprazolam, one of Oxycodone's complements. In contrast, upward trends are observed for deaths with a mention of Heroin or Hydromorphone, two of Oxycodone substitutes. Despite evidence of a shift towards substitute drugs, the magnitude of such shift is small relative to improvements from reductions in Oxycodone deaths. As for provider responses, difference-in-differences estimates suggest that pill-mill heavy counties witnessed an increase in pharmacy openings post intervention. These findings are consistent with anecdotal evidence from DEA reports claiming that the number of pharmacy licensure applications increased to fill the void caused by the enactment of stringent dispensing practitioner laws. Results hold for all three post-intervention years observed, which contrasts with results from similar studies on illegal drugs where interventions have, at most, a short run effect. Findings from this study suggest that in the context of legally provided drugs, supply reduction strategies can be effective in halting abuse.

[8] Dobkin & Nicosia (2009) overcome this limitation by examining an intervention in the market for methamphetamine precursors.

[9] DEA reports claim that opioids such as Oxycodone or Hydrocodone are usually not abused alone, but in combination with alprazolam and carisoprodol.

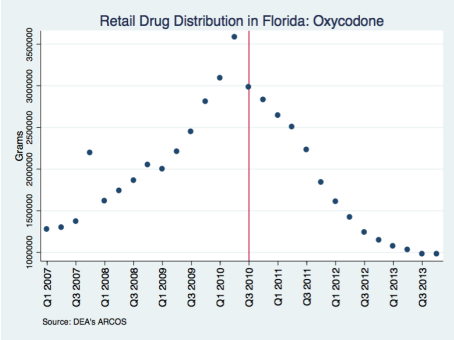
[10] A competing hypothesis worth noting was a change in the controlled-release formulation of OxyContin (oxycodone brand name produced by Purdue Pharma), which took place in August 2010. The new tablet was designed so that it cannot be easily broken, chewed, crushed, or dissolved. Although it's possible that this measure had an effect, it is unlikely a significant factor behind the supply-shock observed in Florida as this is the only state in the nation displaying a trend break in oxycodone sales in quarter three, 2010.

[11] Nonetheless, one can still provide some evidence of their relative magnitudes by exploiting the fact that each generated different treatment groups. For example, consider the enactment of stringent dispensing practitioner laws, which prohibited physicians from dispensing controlled substances in schedules II-III. One could retrieve the effect of this intervention by comparing controlled substances in schedules II-III to controlled substances in schedules IV-V. Although results from this and similar analyses are not included in this document, they will be part of the final paper.

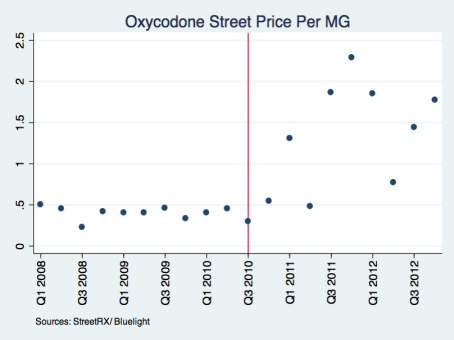
2 Preliminary Results

Preliminary findings for selected outcomes are included below[12]. The post-period is defined as starting in the third quarter of 2010, when the DEA revoked the registration of four wholesale distributors that were supplying rogue pain clinics in south Florida. This date is identified in the graphs with a vertical line.

2.1 First Stage: Evidence of a Supply Shock

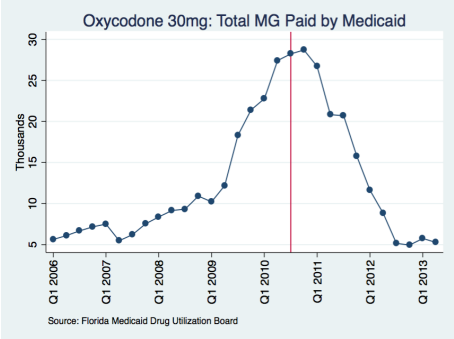


(a) Oxycodone: Total Sales

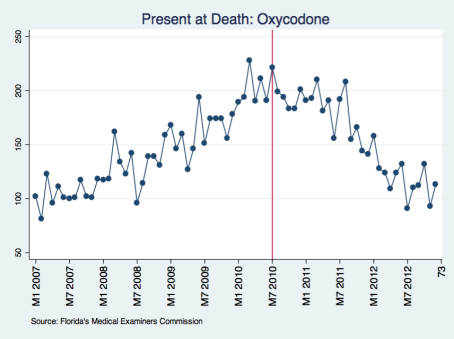


(b) Oxycodone: Street Price

2.2 Public Health

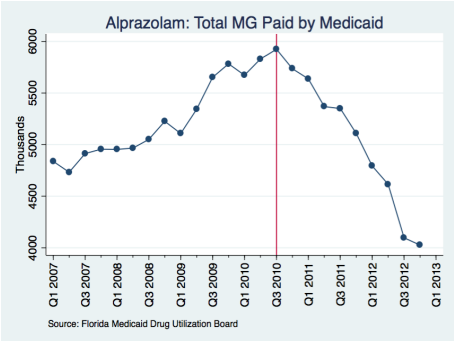


(a) Oxycodone 30mg: Medicaid



(b) Deaths with Mention of Oxycodone

2.3 User Responses: Substitutes and Complements



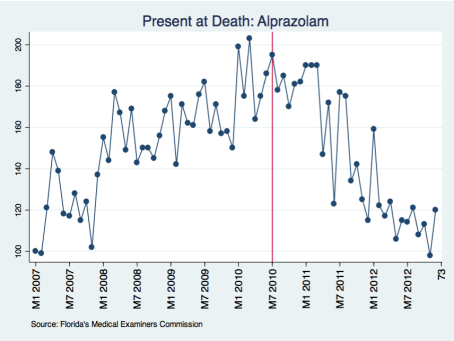
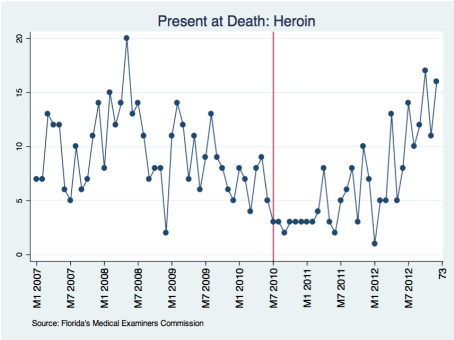


Figure 4: Oxycodone Complement

[12]Since this research is in it's early stages, mostly graphical evidence will be presented. By the time of the conference, results from regression analysis will be included.



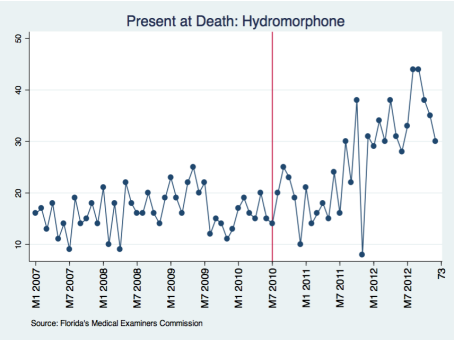


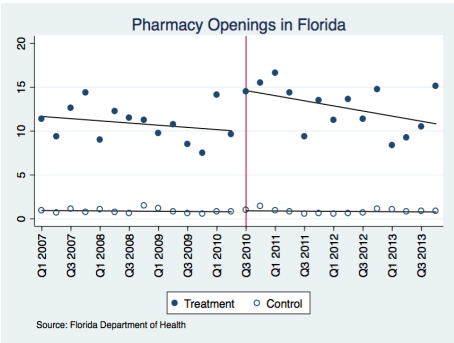
Figure 5: Oxycodone Substitutes

2.4 Provider Responses: Pharmacy Openings

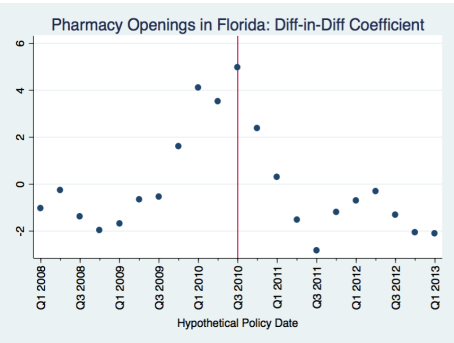
Table 1 displays results from a differences-in-differences analysis that compares counties with pain clinics (treatment group) to counties with no pain clinics (control group). Results from the row labeled "Top Pill Mill Counties" consider treatment the counties with most pain clinics, while results from "Any Pill Mill in County" consider treatment any county with a pain clinic.[13]

Table 1: Pharmacy Openings in Florida

Treatment	**+/- 1 year**	**+/- 2 years**
Top Pill Mill Counties	3.274	4.962
	(3.056)	(3.793)
r2	0.469	0.475
N	130	130
Any Pill Mill in County	0.464	1.247*
	(0.580)	(0.733)
r2	0.060	0.066
N	130	130
Population Mean	2.218	2.323



(a) Treatment: Top Pill Mill Counties



(b) Robustness Check: Hypothetical Policy Date

[13]See extended analysis for a brief discussion of results (four page limit!).

References

[1] Bertrand, M., Duflo, E. & Mullainathan, S. (2004). How Much Should We Trust Differences-in-Differences Estimates? *Quarterly Journal of Economics*, 119(1), 249-275.

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[5] Drug Enforcement Administration. (2012). Prescription Drug Trafficking Trends, Synthetic Drugs and Methamphetamine.

[6] Drug Enforcement Administration. (2013). Drug Trends.

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