

Effects of Prescription Drug Monitoring Programs on Opioid Overdose Mortality

My research journey began like the start of any great adventure: With a trip to the library. With my health economics professor's recommendation, I borrowed and read the 2016 book *Dreamland* from the Athens-Clarke County Library. *Dreamland* tells the tale of America's current opioid overdose crisis, and the tragedy of what I learned prompted me to dedicate my economics senior thesis to exploring this topic.

Drug overdose is now the leading cause of accidental death in the United States, surpassing deaths from motor vehicle every year since 2008, with overdoses from opioids primarily driving this public health epidemic (American Society 2016). Opioids are a class of analgesic compounds that act on chemical receptors found in the brain and are the most widely used drugs for the treatment of pain for the acute and chronic pain (Scott and Lewis 2016). Opioids like oxycodone and hydrocodone are incredibly addictive substances because they act on the same chemical receptors on which the body's own endorphins act and can induce intense feelings of euphoria (Volkow 2014). From 1999 to 2016, the rate of overdose deaths that involve opioids nearly quadrupled, to over 52,000 deaths. (Health and Human 2016). There is a clear need for research that evaluates health policy interventions that reduce opioid overdose mortality. For my economics senior thesis, I am evaluating the effects of the implementation of prescription drug monitoring programs on opioid overdose mortality.

A prescription drug monitoring program (PDMP) is a state-run electronic database that monitors the prescribing and dispensing of controlled substances, like prescription opioids. Using a PDMP, a prescriber or pharmacist can access information about a patient's prescription history of controlled substances to identify patients at high-risk for abuse or patients who are "doctor shopping," trying to obtain prescriptions from multiple healthcare providers for nonmedical use

(Patrick et al. 2016). PDMPs are a relatively new policy tool to combat opioid abuse and mortality for many states, with dozens of states having implemented PDMPs in the last decade.

As an economics and biology major, I wanted to explore the clinical science of opioids and addiction in my thesis' introduction before moving on to evaluate the health policy intervention of PDMPs. Due to the breadth of a topic like opioids and addiction, parsing through all of the relevant research in both the economics and medical literature was overwhelming at first. Though I could get a pretty good initial orientation of my topic through a couple of Google searches, thoughtful academic exploration required a better way of combing through the existing knowledge.

My main research began with the use of UGA Libraries' Multi-Search with the keyword of "opioid." As you can imagine, this returned too many results to handle. In re-evaluating my research strategy, what I found indispensable were the ways I could refine my search to my needs using the UGA Libraries Multi-Search and the GALILEO@UGA database. Utilizing phrase searching, altering the publication date to the last 5 years, and changing the content provider to MEDLINE, I was able to access the best recent biomedical literature on opioids. I also accessed the premier journals in medicine directly, like the Journal of the American Medical Association and The New England Journal of Medicine. Having access through the UGA Libraries network to full-text articles of these journals was invaluable, as much of my research was done at home, off the campus Wi-Fi network. There has not been one article or source that I have been unable to access, from well-known prestigious journals to old foreign medical journals.

Next, my aim was to review the existing health policy literature. There are only a few nationwide evaluations regarding the effects of prescription drug monitoring programs on opioid overdose deaths, many of which are several years old and whose results are conflicting (Griggs et al. 2016). It was in this stage of my research that the suggestions from Keith Nichols, a UGA

public health research librarian, were incredibly useful. Using his recommendation of exploring the citation mapping tool of the Web of Science database, I was able to start with the most recent papers published on PDMPs and opioid mortality in 2017 and track their cited references back in time. Additionally, using the powerful search tool of truncation allowed me to broaden my searches to include various word endings, spellings, and versions of a word stem, with the use of an asterisk. For example, I could search “prescri*” and it would return results with the words “prescription” and “prescribing.” Using these research tools for my literature review allowed me to obtain a coherent orientation of the existing body of knowledge on the topic and to discover the most widely cited work in the field.

In preparation for my thesis, I took an econometrics course in the Fall so I could have the necessary background to design a thesis with a rigorous statistically methodology in the Spring semester. To design my study, I brought four PDMP papers that seemed to have a relatively robust study design to a meeting with my thesis research advisor, Dr. Vincent Pohl, a health economist at the University of Georgia, and we designed the econometric analysis of my thesis. We identified some of the weaknesses of the previous studies so my work could build productively on the existing work. For the central analysis for my paper, the plan was to use a difference-in-difference multivariate regression to evaluate the effects of PDMP implementation on opioid overdose mortality. Since PDMP implementation is under the purview of individual states, we were able to use an interrupted time series design to create a robust study design, since different states decided to implement their PDMPs in difference years. I found reading supplemental econometrics texts like the incredibly accessible *Mastering Metrics* by Joshua Angrist and Jörn-Steffen Pischke also very important. Because I am hoping to have my thesis published in a health policy journal, I need to concisely and properly describe my methodology using the traditional economists’ jargon.

Engaging in high quality health policy work hinges on having good data to analyze. In searching for good data, I came across the Centers for Disease Control's Wide-Ranging Online Data for Epidemiologic Research (WONDER) database. WONDER provides access to mortality data from 1999 to 2015 for every cause of death reported in the United States. For my research, I queried the WONDER database for the prescription opioid overdose mortality data for all 50 states from 1999 to 2015. I now had my "y variable" for my analysis: time series mortality for all 50 states. I then worked to compile the date of implementation for each state's PDMP. For this, I accessed the online Prescription Drug Abuse Policy System (PDAPS), a database funded by the National Institute on Drug Abuse, which is updated by legal researchers. PDAPs had the "x variable" I needed: the dates of implementation for every state's PDMP.

Using Stata, statistical data analysis software, I ran the difference-in-difference regression, applying all of what I had learned about statistical methodology: generating the proper dummy variables, correcting for unobserved heterogeneity among states, and so on. A couple of weeks ago, when I had finished running the preliminary analysis, I was ecstatic to have obtained statistically significant results: the implementation of a PDMP in a state that did not previously have one was correlated with a decrease in 0.84 opioid overdose deaths per 100,000 people per year. In a state of Georgia's population, this would be a reduction of around 8.5 deaths per year. Around 800 people per year die of opioid overdoses in Georgia, so this reduction of 8.5 is huge.

Attending medical school next year, I am interested in exploring the critical intersections between medicine and economics in order to treat patients while also working to leverage policy tools to tackle public health issues. While I am currently finishing up the write-up of my thesis, I am grateful at having a chance to explore a topic that blends my two interests and to have developed some of the skills I need to do health policy research in the future.

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