Project Title: Prescribing of Opioid among Medical Professionals

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1. Introduction:

Drug related deaths have steadily increased in the few decades. In 2016, approximately 63,693 Americans died from drug-overdosing. Noting that there may be more than one drug involved, of the deaths, 42,249 (66.4%) involved at least one prescription and/or illegal opioid. Prescription opioid was involved in 17,087 (40.4%) of the opioid related deaths. (Overdose Death Rates, 2018)

Due to their addictive nature, opioids are treated as controlled substances in the United States. Examples of opioids are heroin, oxycodone, hydrocodone, morphine, fentanyl, among others. Heroin is a schedule I drugs, deemed as having no medical use, unsafe to use, and illegal in all cases. Oxycodone, methadone, morphine are examples of schedule II opioids. Scheduling divides controls drugs into five categories used FDA and the DEA in order determine a drugs risk of abusing and level of medical acceptability. Lower number scheduling indicates higher potential of abuse and higher medical regulation. In the last few decades, there has been concern over the abuse of prescription opioids, in particular Oxycontin, an oxycodone hydrochloride salt approved in 1995 by the FDA as an anesthetic for those with moderate to severe pain. At the time Oxycodin was generally thought to be less additive due to the tablet's delayed onset of action. However, according to a 2005 study, it is the most heavily abused of the schedule II/III opioids. (Cicero, Inciardi, & Munoz, 2005)

2. Business Case and Value Proposition

In 2017, 17% of individuals in the US were prescribed one or more opioid [2]. In 2016, it was estimated that 11.5 million or 4.3% of US population over the age of twelve misused illegal or prescription opioids [2]. Not only does the misuse of opioids cost lives but there is also a financial cost. Based on 2013 data, it was estimated that the economic burden for the misuse of opioids was $78.5 billion. The health care costs to private insurance companies was $14.0 thousand per patient. (Florence, Zhou, Lou, & Xu, 2016) It is therefore in the interest of these companies to track the misuse to prescription opioids.

3. Data Set Overview

The opioid data for this project comes from a 2013 Medicare Part D data set of the opioid prescription of health providers around the United States. This set have the total opioids and total number of drugs prescribe, the zip code, and state of each health provider. It is important to note that since the data is of the prescriptions for patients on Medicare Part D, the

data will reflect an older population. Individuals on Medicare Part D are 65 or older and it is expected they may require painkillers at a higher rate than the general public.

From this data set, both specialty, and location can be correlated with the amount of opioids prescribed. Using data from the 2010 census of the population, the population of each zip code can be determined, and correlated with the levels of opioid prescription.

4. Tentative Solution / Approach

Outlier detection is the primary method to look for possible red flags of opioid abuse. The attributes primarily of interest are the specialties, population, and percentages of opioid prescribed. These attributes will be used to determine clusters. For each cluster, the normal range of opioid prescribed will be determined, and specialties n each clusters will be examined. Further, it will be examined whether the grouping makes sense based on specialty and population. Finally, it will be determined if there are any outliers based on the clusters. Analysis will also find out the health care providers, for whom that percentage of opioid use is outside more than 3 standard deviations from the mean based on the specialty and population of the area.

5. Deliverables

The entire analysis will be posted on github as IPython notebook. All modeling methods will be provided in a Jupyter notebook along with the corresponding visualizations of results.

6. Timelines

- The analysis is expected to be completed by the end of November 2018.
- The final report and IPython notebook will be uploaded on github by mid-December 2018.

7. References

[1] T. J. Cicero, . J. A. Inciardi and A. Munoz, "Trends in Abuse of Oxycontin and other Opioid Analgesics in the United States:2002-2004," *J Pain.,* pp. 662-72., 2005.

[2] "Overdose Death Rates," August 2018. [Online]. Available: https://www.drugabuse.gov/related-topics/trends-statistics/overdose-death-rates. [Accessed 31 October 2018].

[3] "Annual Surveillance Report of Drug-Related," Center for Disease Control and Prevention, 2018 .

[4] C. S. Florence, C. Zhou, F. Lou and L. Xu, "The Economic Burden of Prescription Opioid Overdose,," *Med Care,* vol. 54, no. 10, pp. 901-906, 2016.