Opioid Abuse by Neighborhoods in Tempe, AZ

Introduction

The misuse of and addiction to opioids, including prescription pain relievers, heroin, and synthetic opioids such as fentanyl, is a serious national crisis that affects public health as well as social and economic welfare. Death rate due to opioid overdoes in Arizona increased from 8.2 per 100,000 individuals in 2012 to 13.5 per 100,000 individuals in 2017. Arizona Department of Health Services has declared a public health emergency in 2017 to address the dramatic increase in opioid death in Arizona.

Tempe is a city to the east of Phoenix in Arizona and is the location of the Arizona State University. It has a population of 185,038 in 2017 according to the Census Bureau Report. The city covers 8 zip codes. Below is a map showing that the city is mainly covered by the 4 zip codes: 85281, 85282, 85283 and 85284.

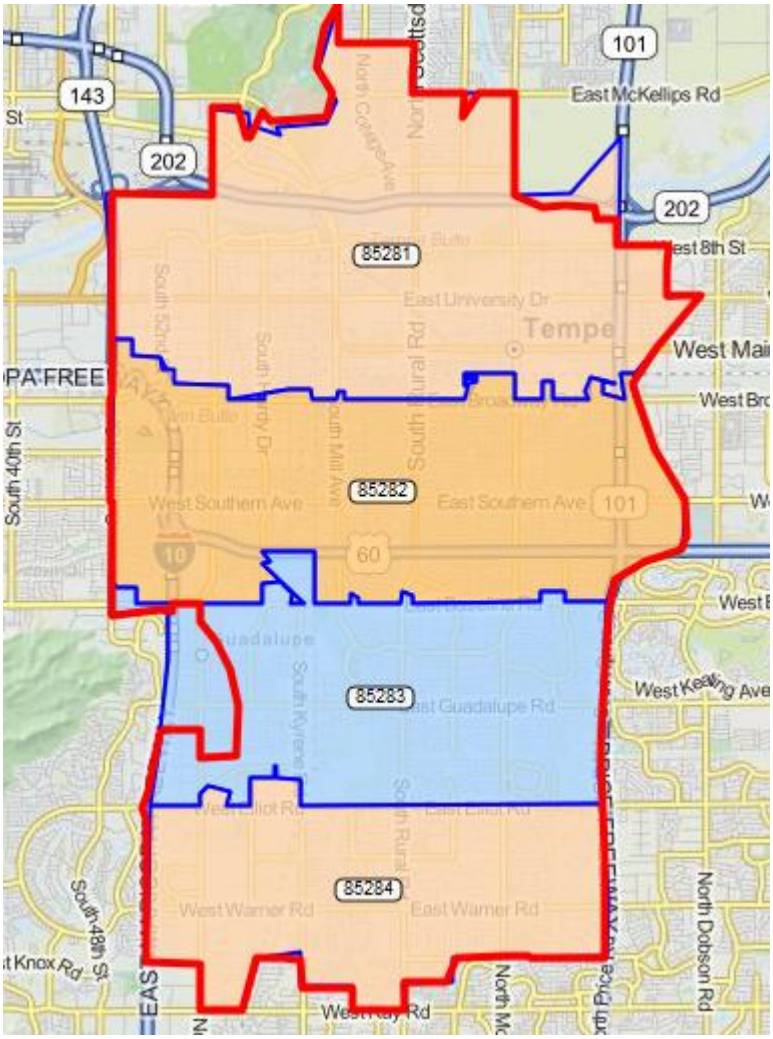

Figure 1. The city of Tempe by zip code.

The city has been collecting all emergency medical services calls related to possible opioid abuse, and the dataset is available to public.

In this study, I explored the possible opioid abuse in the city of Tempe by zip codes. The same zip codes were then used to query Foursquare location data for popular venues in the area. Different areas were then compared by feature of venues and the probability of possible opioid abuse. The result may shed light on the features of the environment and opioid abuse.

Methodology

The city of Tempe collects and maintains a dataset of emergency calls due to opioid abuse and the dataset is available to the public. The raw dataset can be downloaded from the website: https://data.tempe.gov/dataset/opiod-ems-calls/resource/43d02a7a-91e7-4b86-9ae1-1e143369f8b6. The raw dataset has a total of 20 variables and 876 records corresponding to opioid abuse related EMS calls from 01/2017 to 03/2019. 9 variables were selected for analysis and these are: Incident date, day of week, month, Opioid use probably, gender, age, ASU(Arizona State University) student, veteran and homeless. Only records with Opioid use probably='yes' were included in the analysis.

Frequencies of EMS calls were calculated against the following categorical variables: day of week, month, gender, age, ASU student, veteran and homeless. Bar graph showed that most of the EMS calls occurred to the people at the age group of 25-29. This is followed by the age group of 20-24 and 30-34. The 3 age groups when combined accounts for more than half (54%) of the opioid emergency calls(figure2). In addition, EMS calls from males were twice as many as calls from females, indicating that males are more likely to be involved in opioid abuse (figure3). People who are homeless also showed a relative high percentage of overdose (figure4). On the other hand, opioid abuse does not seem to have an association with indicators such as day of week, month, ASU student or veteran (figure not shown here but can be found in the notebook).

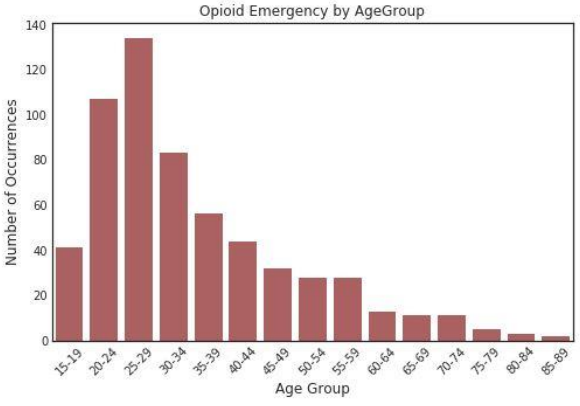

Figure 2. EMS calls by age group.

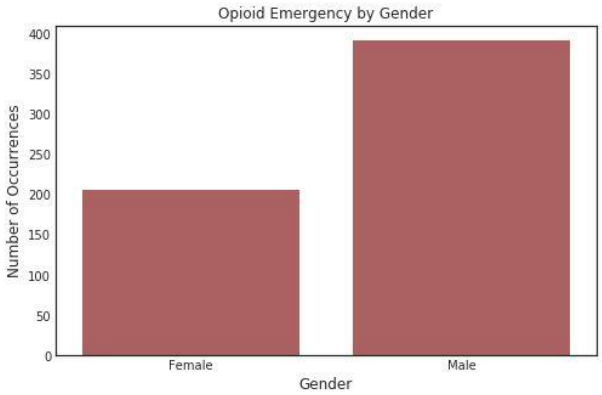

Figure 3. EMS calls by gender

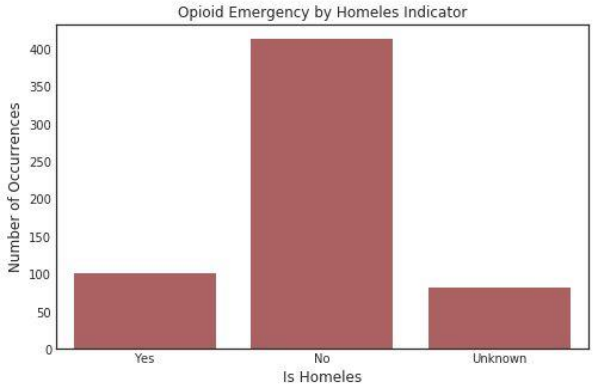

Figure 4. EMS calls by homeless indicator

Since the EMS call dataset include the longitude and latitude of each occurrence, the locations were visualized using Folium. The locations of occurrence seem evenly spread around the city of Tempe and there were some hotspot visible in 85281 and 85282 (figure 5). The location was then reverse geocoded to zip code using the Google Map API. Frequency analysis showed that zip code 85281 has the highest frequency of overdoes (48%). This is followed by the zip code 85282 (31%) and 85283 (11%) (Figure 6).

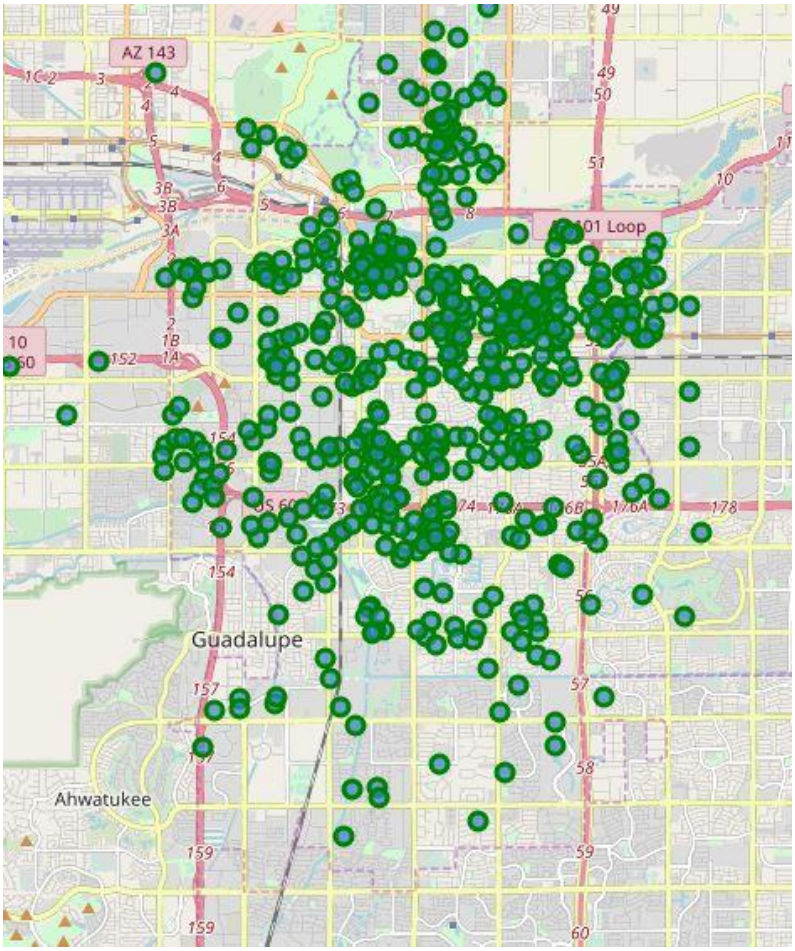

Figure 5. Location of the EMS calls

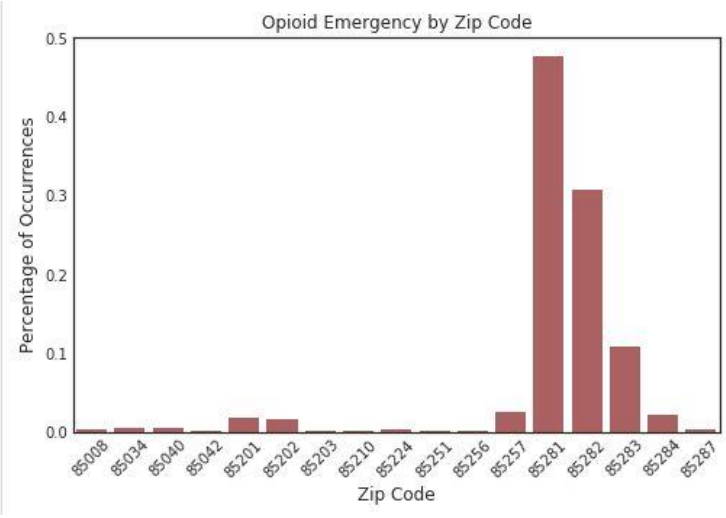

Figure 6. frequency of EMS calls by zip code.

The city of Tempe has a total of 8 zip codes: 85202, 85280, 85281, 85282, 85283, 85284, 85285, and 85287. Among them, 6 zip codes have opioid related EMS calls. The analysis was then focused on the 6 zip codes. Venues located within the 6 zip codes were requested from Foursquare API and featured venues within each zip code was ranked and analyzed. K Mean clustering was used to group the 6 neighborhoods into 3 clusters. Results showed that cluster 1 contains 4 zip codes and was associated with 80% of the opioid related EMS calls. The cluster is featured by parks, restaurants and retail stores. Cluster 2 and 3 both contain 1 zip code each. Cluster 2 has 11% of the EMS calls and was featured by baseball fields, tennis court and disc golf. Cluster 3 has 2.2% of the calls and was featured by lawyer's office and restaurants. (Figure 7)

	zipcode	percentage_of_total	Cluster Labels	No1 Venue	No2 Venue	No3 Venue	No4 Venue	No5 Venue
0	85281	0.477169	1	Park	Plaza	Trail	Clothing Store	Music Venue
1	85282	0.308219	1	Gym / Fitness Center	Pizza Place	Chinese Restaurant	Café	Taco Place
2	85283	0.108447	2	Baseball Field	Tennis Court	Vietnamese Restaurant	Clothing Store	Disc Golf
4	85284	0.021689	0	Lawyer	Plaza	Food	Vietnamese Restaurant	Clothing Store
6	85202	0.015982	1	Pizza Place	Vietnamese Restaurant	Mexican Restaurant	Aquarium	Convenience Store
11	85287	0.003425	1	American Restaurant	Coffee Shop	Bagel Shop	Halal Restaurant	Sandwich Place

Discussion

In summary the analysis shed lights on the feature of the location and the likelihood of opioid abuse. Opioid abuses are more likely to happen around parks, restaurants and stores, probably because these places provide a habitat for homeless. On the other hand, they are less likely to happen around offices or gyms. Future analysis, preferably with a larger set of data, or neighborhoods with more distinct natures, may give more insight on the relationship between environments of the neighborhoods and opioid abuse.