The Battle of Neighborhoods

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CAPSTONE PROJECT
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Introduction
Business Problem

A Health Care Insurance company is concerned with an increasing number of people with alcohol and drug dependencies year over year. They would like to understand if in addition to socioeconomic factors (education, income and occupation) – proximity to places that sell alcohol is a contributing factor as well.

Data

One way of solving the problem is to look at Inpatient Charge Data provided by Centers of Medicare and Medicaid Services.

https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Medicare-Provider-Charge-Data/Inpatient2011.html

The data provided here include hospital-specific charges for more than 3,000 U.S. hospitals that receive Medicare Inpatient Prospective Payment System (IPPS) payments for the top 100 most frequently billed discharges, paid under Medicare based on a rate per discharge using the Medicare Severity Diagnosis Related Group (MS-DRG) for Fiscal Year (FY) 2011.

We will only include data with DRG 897 – ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O REHABILITATION THERAPY W/O MCC and Provider State MN - Minnesota. Then, in combination with the Foursquare location data we will compare the neighborhoods of two analogous cities with the highest and lowest discharge rate for DRG 897, and determine how similar or dissimilar their neighborhoods are. We will learn if one city has more venues (e.g. bars, liquor stores) that sell alcohol then the other.

Methodology

For the purpose of this analysis, we start by reviewing Inpatient Charge Data provided by Centers of Medicare and Medicaid Services. Although, big metropolitan cities like Minneapolis and St Paul always stand out due to the size of population that resides there, we'll focus our attention on suburban cities.
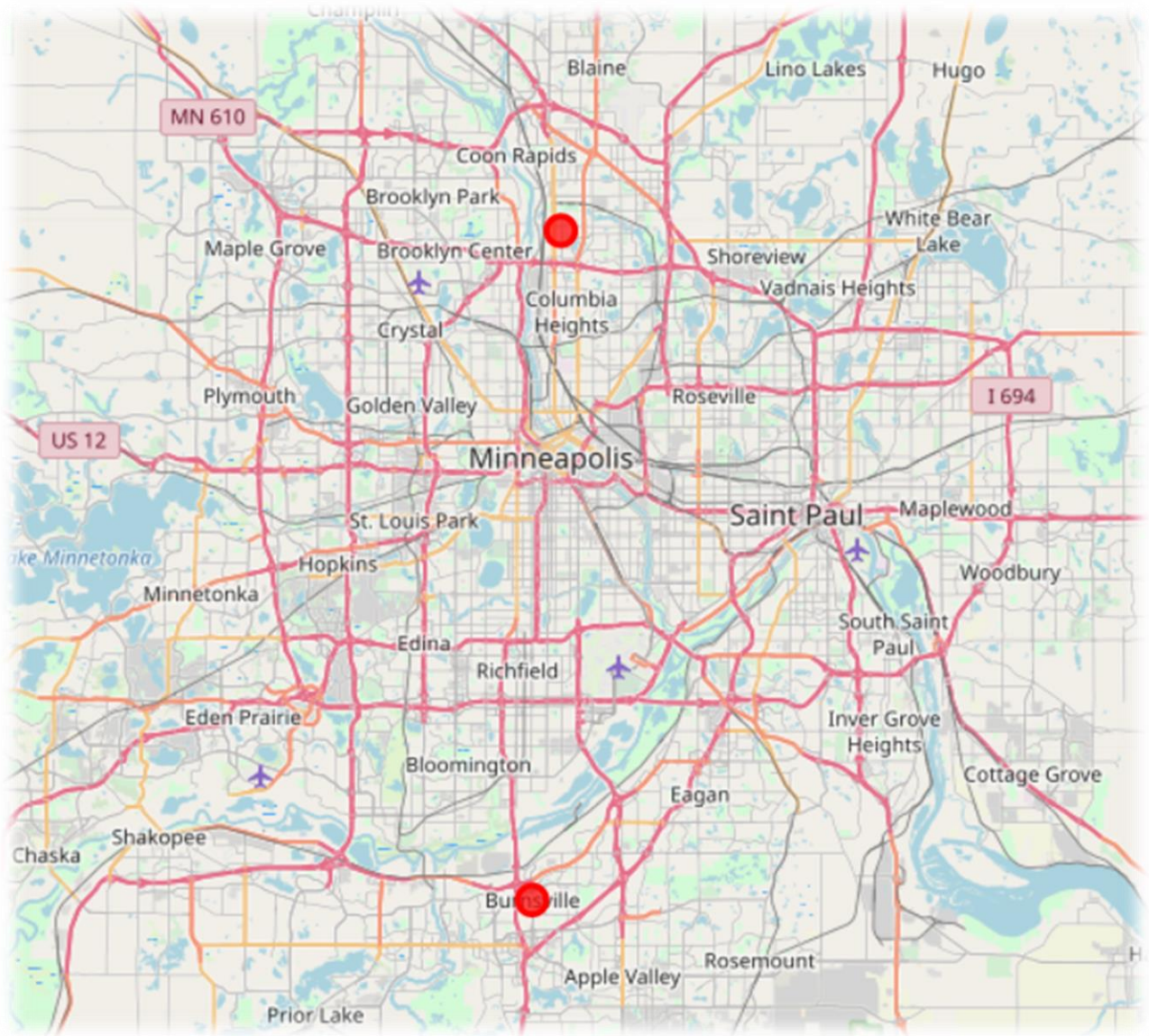
DRG Definition	Provider Id	Provider Name	Provider Street Address	Provider City	Provider State	Provider Zip Code	Hospital Referral Region (HRR) Description	Total Discharges
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240080	UNIVERSITY OF MINNESOTA MEDICAL CENTER, FAIRVIEW	2450 RIVERSIDE AVENUE	MINNEAPOLIS	MN	55454	MN - Minneapolis	138
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240132	UNITY HOSPITAL	550 OSBORNE ROAD	FRIDLEY	MN	55432	MN - Minneapolis	65
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240115	MERCY HOSPITAL	4050 COON RAPIDS BLVD	COON RAPIDS	MN	55433	MN - Minneapolis	53
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240038	UNITED HOSPITAL	333 NORTH SMITH	SAINT PAUL	MN	55102	MN - St. Paul	48
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240063	ST JOSEPH'S HOSPITAL	45 WEST 10TH STREET	SAINT PAUL	MN	55102	MN - St. Paul	45
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240106	REGIONS HOSPITAL	640 JACKSON STREET	SAINT PAUL	MN	55101	MN - St. Paul	45
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240010	MAYO CLINIC - SAINT MARYS HOSPITAL	1216 SECOND STREET WEST	ROCHESTER	MN	55902	MN - Rochester	41
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240036	ST CLOUD HOSPITAL	1406 6TH AVE NORTH	SAINT CLOUD	MN	56303	MN - St. Cloud	40
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240057	ABBOTT NORTHWESTERN HOSPITAL	800 EAST 28TH STREET	MINNEAPOLIS	MN	55407	MN - Minneapolis	40
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240053	PARK NICOLLET METHODIST HOSPITAL	6500 EXCELSIOR BLVD	SAINT LOUIS PAR	MN	55426	MN - Minneapolis	37
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240004	HENNEPIN COUNTY MEDICAL CENTER	701 PARK AVENUE	MINNEAPOLIS	MN	55415	MN - Minneapolis	31
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240001	NORTH MEMORIAL MEDICAL CENTER	3300 OAKDALE NORTH	ROBBINSDALE	MN	55422	MN - Minneapolis	26
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240078	FAIRVIEW SOUTHDALE HOSPITAL	6401 FRANCE AVENUE SOUTH	EDINA	MN	55435	MN - Minneapolis	21
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240047	ST LUKES HOSPITAL	915 E 1ST ST	DULUTH	MN	55805	MN - Duluth	20
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240002	ESSENTIA HEALTH ST MARY'S MEDICAL CENTER	407 E 3RD ST	DULUTH	MN	55805	MN - Duluth	19
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240117	MAYO CLINIC HEALTH SYSTEM - AUSTIN	1000 FIRST DRIVE NORTHWEST	AUSTIN	MN	55912	MN - Rochester	19
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240075	ESSENTIA HEALTH ST JOSEPH'S MEDICAL CENTER	523 NORTH 3RD STREET	BRAINERD	MN	56401	MN - Minneapolis	18
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240040	UNIVERSITY MEDICAL CENTER-MESABI/ MESABA CLINICS	750 EAST 34TH ST	HIBBING	MN	55746	MN - Minneapolis	16
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240093	MAYO CLINIC HEALTH SYSTEM - MANKATO	1025 MARSH STREET BOX 8673	MANKATO	MN	56002	MN - Minneapolis	16
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240210	HEALTHEAST ST JOHN'S HOSPITAL	1575 BEAM AVENUE	MAPLEWOOD	MN	55109	MN - St. Paul	16
897 - ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O	240207	FAIRVIEW RIDGES HOSPITAL	201 EAST NICOLLET BOULEVARD	BURNSVILLE	MN	55337	MN - Minneapolis	12

Figure 1. DRG Summary for Medicare Inpatient Prospective Payment Hospitals, FY2011

To verify the two cities with highest and lowest discharge rate for DRG 897, in our case a city of Fridley (northern Minneapolis suburb) and a city of Burnsville (southern Minneapolis suburb), are comparable and suitable for our study - we will reference US Census data.

https://www.census.gov/search-results.html?searchType=web&cssp=SERP&q=Burnsville%20city,%20MN
https://www.census.gov/search-results.html?q=Fridley&page=1&stateGeo=none&searchtype=web&cssp=SERP&_charset_=UTF-8

Indeed, these are two suburban cities, that are located within 15 miles north and south of downtown Minneapolis in the State of Minnesota.

Fridley is a "first ring" or "inner ring" suburb in the northern part of the Twin Cities, and has a total area of 10.89 square miles.

Burnsville is situated on the south bank of the Minnesota River and considered a "second ring" suburb of the Twin Cities. The city has a total area of 26.93 square miles.

Demographic data provided by US Census Bureau give us a better understanding about the population and economic development of the cities.

Burnsville city, Minnesota

2018 Population Estimates
61,203
Source: Vintage 2018 Population Estimates

Median Household Income
$ 67,397
Source: 2013-2017 American Community Survey 5-Year Estimates

Persons in poverty, percent
9.3 %
Source: 2013-2017 American Community Survey 5-Year Estimates

Educational Attainment: Percent high school graduate or higher
93.1 %
Source: 2013-2017 American Community Survey 5-Year Estimates

Persons without health insurance, percent
6.4 %
Source: 2013-2017 American Community Survey 5-Year Estimates

Median Housing Value
$ 224,700
Source: 2013-2017 American Community Survey 5-Year Estimates

Total Housing Units
25,657
Source: 2013-2017 American Community Survey 5-Year Estimates

Number of Firms
6,595
Source: 2012 Survey of Business Owners: Company Summary

Male Median Income
$ 41,670
Source: 2013-2017 American Community Survey 5-Year Estimates

Female Median Income
$ 27,855
Source: 2013-2017 American Community Survey 5-Year Estimates

Veterans
3,791
Source: 2013-2017 American Community Survey 5-Year Estimates

Percent of households with a broadband Internet subscription
85.1 %
Source: 2013-2017 American Community Survey 5-Year Estimates

Explanation of Symbols

Fridley city, Minnesota

2018 Population Estimates
27,742
Source: Vintage 2018 Population Estimates

Median Household Income
$ 56,583
Source: 2013-2017 American Community Survey 5-Year Estimates

Persons in poverty, percent
10.7 %
Source: 2013-2017 American Community Survey 5-Year Estimates

Educational Attainment: Percent high school graduate or higher
89.3 %
Source: 2013-2017 American Community Survey 5-Year Estimates

Persons without health insurance, percent
8.4 %
Source: 2013-2017 American Community Survey 5-Year Estimates

Median Housing Value
$ 174,000
Source: 2013-2017 American Community Survey 5-Year Estimates

Total Housing Units
11,283
Source: 2013-2017 American Community Survey 5-Year Estimates

Number of Firms
2,449
Source: 2012 Survey of Business Owners: Company Summary

Male Median Income
$ 35,863
Source: 2013-2017 American Community Survey 5-Year Estimates

Female Median Income
$ 25,003
Source: 2013-2017 American Community Survey 5-Year Estimates

Veterans
1,411
Source: 2013-2017 American Community Survey 5-Year Estimates

Percent of households with a broadband Internet subscription
82.4 %
Source: 2013-2017 American Community Survey 5-Year Estimates

Explanation of Symbols

Figure 2. U.S. Census Bureau QuickFacts

The exhibit above illustrates that Burnsville is larger (by size and population) and a little bit more prosperous than Fridley. However, we still believe, given their geographical location and demographics, the two cities are very comparable.

Now we will use Foursquare location data to study the neighborhoods of two analogous cities with the highest and lowest discharge rate for DRG 897, and determine how similar or dissimilar their neighborhoods are. We will learn if one city has more venues (e.g. bars, liquor stores) that sell alcohol then the other.

To accomplish this, we will use the geolocator function of Nominatim to find the geo coordinates of Burnsville and Fridley. Then we will use latitude and longitude of each city to pull the venues in the 5000-meter radius.

The query returned 97 venues for Burnsville and 100 venues for Fridley, with 97 unique categories overall.

Next, we'll analyze each neighborhood and calculate the mean of the frequency of occurrence of each category. Then print each neighborhood along with the top 20 most common venues.

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----Burnsville----                          ----Fridley----
                       venue  freq                            venue  freq
0                Coffee Shop  0.06          0                Pizza Place  0.06
1              Grocery Store  0.04          1                Coffee Shop  0.05
2        American Restaurant  0.03          2        Fast Food Restaurant  0.05
3             Sandwich Place  0.03          3             Sandwich Place  0.05
4          Mexican Restaurant  0.03          4          Chinese Restaurant  0.04
5       Gym / Fitness Center  0.02          5          Mexican Restaurant  0.04
6           Italian Restaurant  0.02        6        American Restaurant  0.04
7             Lingerie Store  0.02          7               Liquor Store  0.04
8                Gas Station  0.02          8                     Bakery  0.03
9                       Park  0.02          9              Grocery Store  0.03
10                 Disc Golf  0.02          10            Lingerie Store  0.02
11                  Pharmacy  0.02          11                      Park  0.02
12                Pizza Place  0.02         12          Asian Restaurant  0.02
13             Cosmetics Shop  0.02         13                  Bookstore  0.02
14          Convenience Store  0.02         14                Sports Bar  0.02
15           Asian Restaurant  0.02         15                       Bar  0.02
16               Burger Joint  0.02         16          Korean Restaurant  0.02
17                 Shoe Store  0.01         17           Thai Restaurant  0.02
18  Middle Eastern Restaurant  0.01         18                   Library  0.01
19               Intersection  0.01         19               Karaoke Bar  0.01
```

Figure 3. Top 20 most common venues

Results

Indeed, we learned one city has more venues (e.g. bars, liquor stores) that sell alcohol then the other.

Let's display the top 10 most common venues for each neighborhood/city:

Neighborhood	1st Most Common Venue	2nd Most Common Venue	3rd Most Common Venue	4th Most Common Venue	5th Most Common Venue	6th Most Common Venue	7th Most Common Venue	8th Most Common Venue	9th Most Common Venue	10th Most Common Venue
Burnsville	Coffee Shop	Grocery Store	American Restaurant	Sandwich Place	Mexican Restaurant	Park	Pharmacy	Gym / Fitness Center	Lingerie Store	Pizza Place
Fridley	Pizza Place	Fast Food Restaurant	Coffee Shop	Sandwich Place	American Restaurant	Mexican Restaurant	Liquor Store	Chinese Restaurant	Bakery	Grocery Store

Figure 4. Top 10 most common venues

From the figure above we can see the "Liquor Store" is ranked 7th most common venue in Fridley, yet Burnsville has no "Liquor Store" among the top 10 most common venues observed.

When we refer to the previous display of top 20 most common venues, we find there are several bar venues ("Sports Bar", "Bar" and "Karaoke Bar") among the most common venues in Fridley, and no such venues in Burnsville.

The "Liquor Store" venue in Fridley has a mean frequency of occurrence 0.4. In Burnsville the same 0.4 frequency of occurrence has "Grocery Store" which is ranked 2nd most common venue.

It's also worth mentioning that Burnsville has "Park" and "Gym/Fitness Center" among its top 10 most common venues, whereas in Fridley the top 10 most common venues consist of food and beverage places such as restaurants, coffee shops, a grocery store and a liquor store.

Discussion

In an effort to help health care insurance company answer the question whether proximity to places that sell alcohol can be a contributing factor to positive trend of alcohol dependency cases among their members in Minnesota, we have identified two suburban cities in metropolitan area of Minneapolis with the highest and lowest discharge rate for DRG 897 – ALCOHOL/DRUG ABUSE OR DEPENDENCE W/O REHABILITATION THERAPY W/O MCC. Then, we studied the population of two cities to determine whether it's comparable and can be used in our analysis to answer the question. We decided that given geographical location and demographics of Burnsville and Fridley, the two cities are very comparable.

We utilized Foursquare location data to study the neighborhoods of chosen cities and learn what the most popular venues are. Indeed, the analysis revealed that the city of Fridley had Liquor Store as the 7th most common venue, as well as various bars in the top 20 most common venues category. The city of Burnsville had none.

Conclusion

Perhaps, the discharge data used in the analysis can be called outdated, we still believe the findings outlined here are important. Our analysis confirms the hypothesis that in addition to socioeconomic factors (education, income and occupation) – proximity and easy access to places that sell alcohol contribute to the rate of consumption, and therefore alcohol addiction.

Medical health data are not readily available and often contain protected PHI. Therefore, the insurance company is advised to conduct its own analysis utilizing member health data to study their population and environmental influence on it. Medical health insurance company can partner with cities to address its concerns about increasing number of people with alcohol and drug dependencies year over year for the city's population and call to implement the measures to limit the access to alcohol.