Title: Potential availability and access to primary health care in a neighbourhood

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1. Introduction

Access to health care services is important in maintaining health, preventing/ managing disease, and reducing premature death. This means that availability and timely access/use of primary health services is needed; Having close access to needed health care services (or geographic availability) is one factor in achieving a successful outcome for ill patients.

Problem:
A person suddenly falls ill with symptoms similar to flu, yet he/she cannot be sure it is not covid19. Given the current health, he/she cannot wait for a doctor's appointment, but the emergency services/ hospitals might not be necessary (yet!). In such an event, would this person have quick access to a primary health service (in a specific borough/ neighbourhood) to get a primary diagnosis?

Justification:
Firstly, since I am in healthcare, this is an issue that is important to me. Secondly, a person may just have the cold/flu since it is flu season after all. However, the country/ state does not want everybody with flu-like symptoms to overwhelm emergency services/ hospitals. So, it is important to know where the primary care providers are in each borough/ neighbourhood, and to ensure that people from that borough/ neighbourhood have access to those facilities first. Then, they can be transferred to hospitals/emergency services, if necessary.

If there is a lack of primary care providers in rural areas, then they can be advised to visit clinics in adjacent neighbourhoods. One example of this is in Norway, where government officials advise residents not to visit their huts, so as not to overwhelm health services in out-of-reach places. But if one so happens to be in a secluded area, would the person still be able to access primary care providers. Therefore, the aim of this small study is to determine if residents in a borough would have quick access to primary health services in their respective neighbourhood.

2. Methods

2.1 Data

Foursquare API will be utilised to pull the location data in New York. (New York would be used, as a lot less venue data were found in Scandinavia countries). A list of venues near a given location will be accessed, to return a hierarchical list of categories. Response fields like Venue Name, Venue Location and Venue Category would be requested.

2.2 Locations of medical health services

Data of New York was utilised. Data was transformed into pandas (borough, neighbourhood, latitude and longitude). These parameters are important to find locations of health care facilities in specific borough/ neighbourhoods with latitude and longitude coordinates. Borough Manhattan was selected as pilot data.

Foursquare API was used to check for specific venues in Manhattan within a certain radius and a limited number. We specifically used a category ID (cat_ID) to search for 'medical center' and its sub-categories. We are not interested in searching for restaurants and cafes, etc. So using a cat_ID would focus the search on venues related to medicine. 'Medical supply store' and 'medical school' have their own cat_ID and are not part of the search.

Neighbourhoods within Manhattan was searched. Venue categories were filtered to just 'doctor', 'medical', and 'clinic'. 'Hospital' was specifically ignored, as only primary health services were being investigated here. 'Clinic' was later ignored as they only reported 'maternity clinic'. While maternity clinics do have

medical doctors, these venues were ignored because other venues such as ‘doctor’s clinic’ were more specific. Also, if one did test positive for covid19, one should not be in a clinic full of women who are pregnant, or trying to get pregnant.

So it was determined that venue categories filtered to ‘doctor’s clinic’ and ‘medical center’ would sufficiently meet the definition (for a pilot study) of primary health provider. In analysing the data, it should be noted that ‘doctor’s clinic’ have a higher priority than ‘medical center’. This is because medical center includes several descriptions such as vascular centers, audiology, imaging, etc. At this point, details in these descriptions will not be assessed so closely. Thus, so far, this worked well.

2.3 Aggregating medical health services within certain clusters

Using previous data from Manhattan. Each neighbourhood is ranked according to ‘doctors’ clinic’ but data from ‘medical center’ is also included in the data. As mentioned, ‘doctor’s clinic’ have a higher priority than ‘medical center’. This is because there are more family practice, <name> doctors, etc, i.e there are more general practitioners under ‘doctor’s clinic’ than ‘medical center’. However, ‘medical center’ should also be in the data as they could also be primary health services in this category.

To determine whether a person would have quick access to a primary health service within a neighbourhood, one would need to know the medical services available per 1000 residents. In order for each person to have quick assess to health service, there should be sufficient health services available for everyone.

Therefore, we need to get data for the approximate number of residents in each borough/ neighbourhood. Population data was accessed from data.cityofnewyork.us. However, the population data does not match neighborhood data from Foursquare. After joining population data from some neighbourhoods, it was decided that some neighborhoods have to be ignored or combined. This is not useful, as a number of neighbourhoods have to be removed. To circumvent this, a weighted mean of the population data would be used instead. With this mean, we thus know the approximate number of primary health facilities available per 1000 residents in each neighbourhood in Manhattan. Neighbourhoods were ranked based on the density of health facilities per 1000 residents.

K-means was also used to analyse clusters (of available primary health services) within Manhattan. This may enable us to differentiate neighbourhoods based on locations and number of medical centres and doctor’s clinics.

3. Results

3.1 Locations of medical health services

Venues identified as doctor’s clinics and medical centres are plotted in Figure 1.

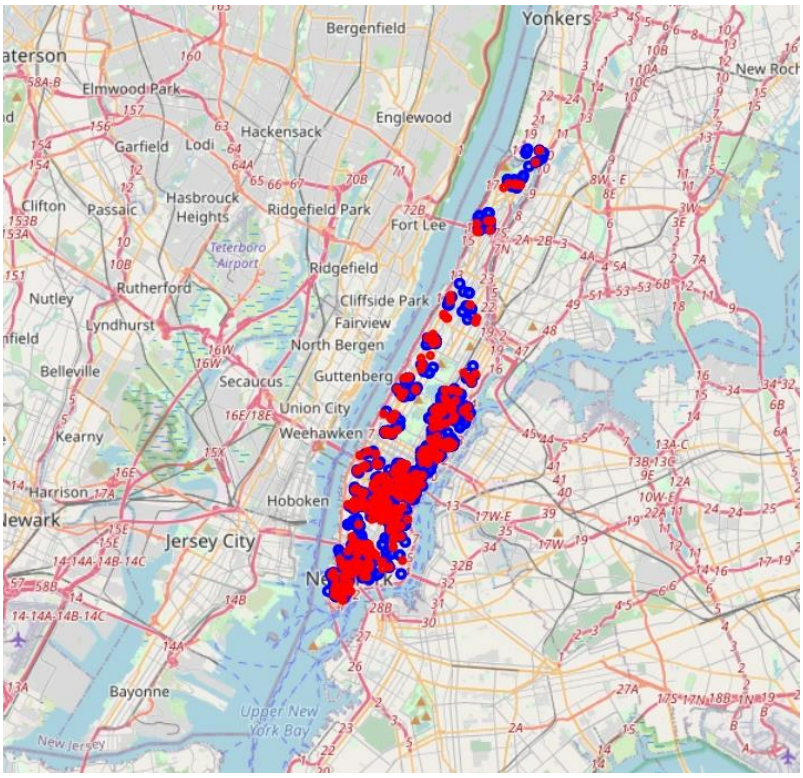

Figure 1: Venues of interest in Manhattan. Red circles are medical centres and blue circles are doctor's clinics

3.2 Analysing density data

Venues per 1000 residents are reported in Tables 1 and 2.

	Neighborhood	Doctor's Office	Medical Center
28	Roosevelt Island	1.590922	0.219437
1	Carnegie Hill	1.554349	0.237724
16	Lenox Hill	1.499490	0.292583
35	Upper East Side	1.408057	0.384016
18	Little Italy	1.334911	0.256010
17	Lincoln Square	1.316625	0.256010
5	Civic Center	1.188620	0.365729
10	Flatiron	1.152047	0.548594
11	Gramercy	1.133760	0.530307
9	Financial District	1.115474	0.548594

Table 1: Top 10 neighbourhoods with doctor's office and medical centers per 1000 residents.

	Neighborhood	Doctor's Office	Medical Center
0	Battery Park City	0.146292	0.091432
6	Clinton	0.146292	0.146292
2	Central Harlem	0.146292	0.036573
19	Lower East Side	0.109719	0.036573
13	Hamilton Heights	0.109719	0.036573
7	East Harlem	0.109719	0.073146
20	Manhattan Valley	0.109719	0.091432
32	Tribeca	0.091432	0.073146
14	Hudson Yards	0.073146	0.109719
21	Manhattanville	0.036573	0.091432

Table 2: Bottom 10 neighbourhoods with least number of doctor's office and medical centers per 1000 residents.

3.3 Analysing clusters

Clusters are plotted in Figure 2.

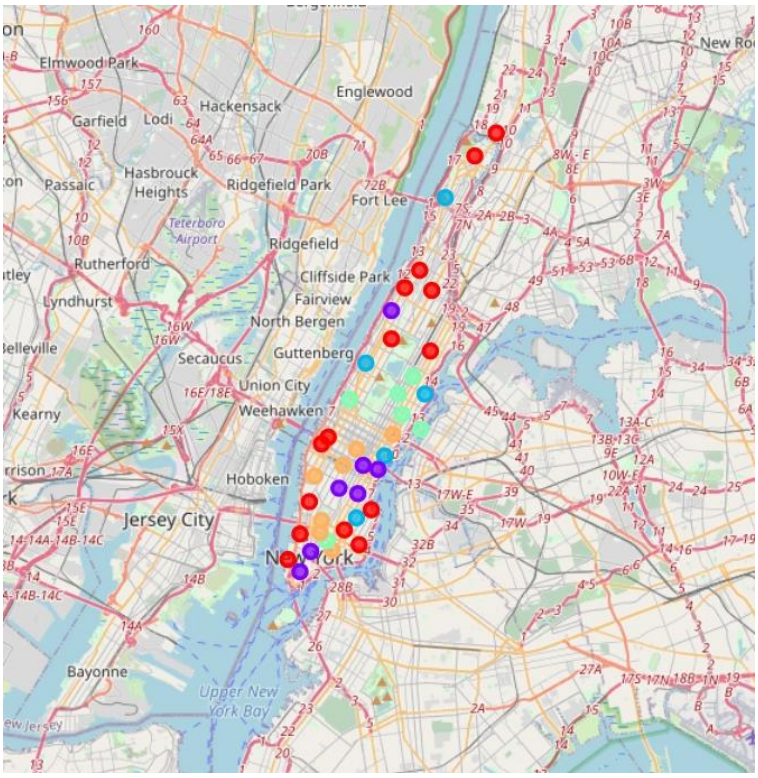

Figure 2: Clusters determined in Manhattan

Cluster 0 (in red) has the least number of doctor's clinics and medical centres. Cluster 2 (in light blue) has the second least number of doctor's clinics and medical centres. Cluster 3 (in light green) has the highest number of doctor's clinics and medical centres. Cluster 1 (in light purple) has the second highest number of doctor's clinics and medical centres.

4. Discussion

From the clusters determined from the data, the closer a person is to the centre of Manhattan, there are higher chances of accessing a primary health service. This is not really surprising as most medical services are in city centres. However, more residents live further away from the city centre, as it is cheaper. And in these uncertain times, residents in neighbourhoods further away from the city centre may not have quick access to a quick health diagnosis.

A limitation in this study is that a lot of data cleaning still needs to be done. For example, 'medical center' includes several venue descriptions such as vascular centers, audiology, imaging, etc, these should be assessed manually and removed. In addition, neighbourhood population data should be assessed in more detail manually; if more neighbourhoods should be combined, divided, etc. This will provide more accurate density results (per 1000 residents).

Conclusion

Neighbourhoods closest to the centre have the highest number/ density of doctor's clinics and medical centres. Neighbourhoods with the least number of doctor's clinics and medical centres were also identified. So residents in those neighbourhoods need to be aware that in these uncertain times, they might be the ones who may not have quick access to a primary health service to receive a primary diagnosis of their illness. The state could also introduce digital health interventions (such as the use of apps) to enable residents assess to a quick health assessment, or direct them to the nearest care facility (if necessary).