

Coursera Capstone Project

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Topic: Optimal hospital building in Lahore

Introduction

The problem

With a population exceeding 150 Million, Lahore is undoubtedly one of the largest cities of Pakistan, the 5th largest country by population. However, Lahore has had a history of being unable to provide adequate medical care to its citizens, especially in the relatively underdeveloped areas.

As the government has a low amount of resources, there is only a small number of hospitals that can be built to cover a number of areas. Some areas are fully covered while some areas are not covered at all. The number of hospitals to be built should cover areas with the lowest amount of healthcare facilities in their vicinity.

Solution

In order to cater to the current problem, I plan to create a map that would display the neighborhoods and the number of hospitals near them. These hospitals will be judged on the number of areas they cater, which will in turn identify the areas to which hospitals are very far. These identified points will then be used to analyze and determine the optimal points for building a new hospital.

Data

Collection Sources

Data will be collected from the following sources:

- [List of towns in Lahore](#)
- Geocode information from Geopy
- Hospital Data in Lahore from Foursquare

Data Type

The data collected includes:

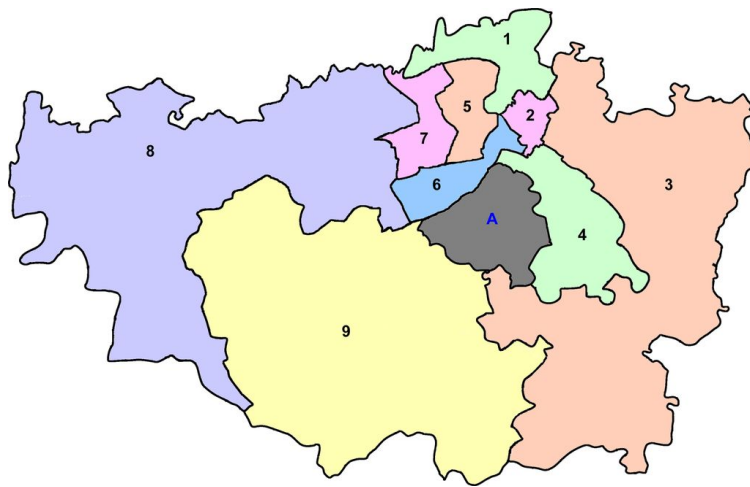
- list of neighborhoods in lahore
- list of hospitals in lahore with their neighborhoods
- Geo location data of hospitals and neighborhoods

Methodology

The project had started with the following milestones in mind:

- Different areas of Lahore will be individualized
- Number of hospitals in each area will be located
- Each hospital is assumed to have a coverage of 7km radius
- Identify which areas have no hospital coverage
- Determine which areas are optimal for a new hospital

According to the first milestone, the location data was collected for all areas within Lahore. Lahore is divided into 9 administrative sections:



These administrative sections have a total of 142 towns or areas under their jurisdiction. Location for each of these areas was needed to be recorded. For this a pandas dataframe object was created using data collected from wikipedia tables. These areas were collected in the form of clustered areas

according to their administrative parties:

#	Town	Union Council
0 1	Ravi	Begum Kot (UC 1) Kot Mohibbu (UC 2) Azizabad (...)
1 2	Shalamar	Bhaghatpura (UC 15) Gujjarpura (UC 16) Rehmatp...
2 3	Wagha	Daroghawala (UC 42) Muhammad (UC 37) Sultan Me...
3 4	Aziz Bhatti	Harbanspura (UC 41) Rashidpura (UC 43) Fatehga...
4 5	Data Gunj Buksh	Kasurpura (UC 67) Ameenpura (UC 68) Kareem Bag...
5 6	Gulberg	Railway Colony (UC 31) Daras Barey Mian (UC 32...
6 7	Samanabad	Abu Bakar Siddique (UC 84) Shamnagar (UC 87) G...
7 8	Iqbal	Awan Town (UC 110: Hassan Town) Saidpur (UC 11...
8 9	Nishtar	Kamahan (UC 63) Hair (UC 64) Dhaloke (UC 66) B...
9 A	Cantonment*	Lahore Cantonment (UC 152: Defence, Cavalry Gr...

These clusters needed to be cleaned into 142 separate towns, which were then searched via OpenCage geopy library. The following head represents the dataframe extracted. There are 3 separate columns namely longitude, latitude and the area:

	Neighborhood	Latitude	Longitude
0	Begum Kot	31.613832	74.265741
1	Bhaghatpura	31.549720	74.343610
2	Daroghawala	31.587253	74.404541
3	Harbanspura	31.566945	74.396377
4	Kasurpura	31.549720	74.343610
5	Railway Colony	31.572491	74.351196
6	Abu Bakar Siddique	31.549720	74.343610
7	Awan Town	31.504234	74.263197
8	Kamahan	31.454575	74.381757
9	Kot Mohibbu	31.549720	74.343610
10	Gujjarpura	31.549720	74.343610
11	Muhammad	31.567129	74.339895
12	Rashidpura	31.549720	74.343610
13	Ameenpura	31.549720	74.343610
14	Daras Barey Mian	31.549720	74.343610
15	Shamnagar	31.553492	74.282973
16	Saidpur	31.549720	74.343610

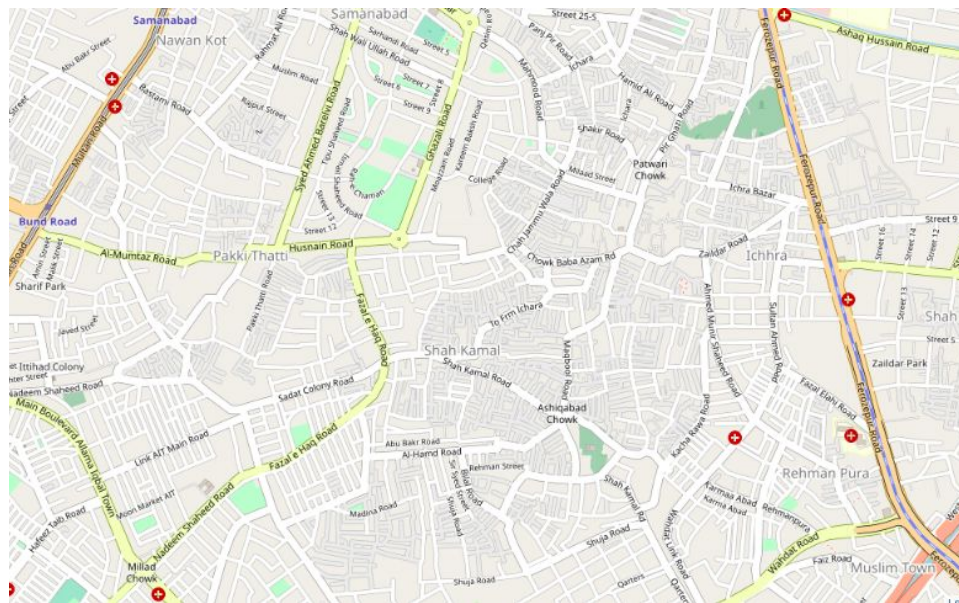
Once these are extracted and organized, there was now time to determine the hospitals that were present in the areas in Lahore. There are 78 hospitals in Lahore:

1. Evercare Hospital Lahore (NESPAK Society, next WAPDA Town Roundabout)
2. Cosmos Health Services (Muslim Town, next to Inmol and CPSP)
3. Mughal Eye Hospital (Mughal Trust) (Johar Town, Lahore)
4. Bilqees Sarwar Hospital (Ferozpur Road)
5. ZB Hospital (Johar Town)
6. Aadil Hospital (D.H.A Lahore)
7. Rashid Hospital(D.H.A Lahore)
8. Physiotherapy Hospital (Lahore,Johar Town)
9. Zaib Hospital (R1 Johar Town)
10. Women Health Care Clinic (Johar Town)
11. Al-Khidmat Hospital, Multan Road
12. Ali eye hospital
13. Arif Memorial Teaching Hospital
14. Arshi Medical Complex, Ichra, Lahore
15. Avicenna Hospital
16. Pain Hospital Lahore

17. Bahria Town Hospital
18. Bajwa Hospital, Iqbal Town
19. City Hospital Mohlanwal Lahore
20. Chaudhary Muhammad Akram Teaching & Research Hospital 17 km Raiwind road,Lahore
21. Doctors Hospital
22. Farooq Hospital
23. Fatima Memorial Hospital
24. Family Hospital
25. Fauji Foundation Hospital
26. Ganj Baksh Spinal Research & Rehabilitation Hospital
27. Ghurki Trust Hospital
28. Gulberg Hospital
29. Hameedah Memorial Hospital (Valencia Housing Society)
30. Haleema Memorial Foundation Hospital
31. Hameed Latif Hospital
32. Hijaz Hospital
33. Ittefaq Hospital
34. Masood Hospital
35. Mid City Hospital, Lahore
36. Mumtaz Bukhtawar Memorial Trust Hospital Raiwind Road,Lahore. Unit 2
37. National Hospital
38. Prime Care Hospital
39. Ramzan Ali Memorial Hospital
40. Salma Sarfraz Hospital
41. Shalamar Hospital (Institute of Health Sciences)
42. Shaukat Khanum Memorial Cancer Hospital & Research Centre
43. Omar Hospital & Carddiac Center (Jail Road)
44. OMC, Jail Road
45. Surgimed Hospital
46. Surraya Azeem Hospital, Chowburji Chowk, Lahore
47. Makhdoom Hospital
48. Zahida Welfare hospital
49. Mumtaz Bukhtawar Memorial Trust Hospital Wahdat Road, Lahore.Unit 1
50. University Dental Hospital - University of Lahore
51. University Teaching Hospital - University of Lahore
52. Zia Hospital, Ferozpur Road
53. Health Bridge Hospital
54. Muslim Hospital, Abu-Buker Street, Sodiwal Lahore.
55. Paragon Medical Complex, Paragon City, Barki Road, Lahore, (opposite DHA Phase-8)
56. Combined Military Hospital Lahore
57. Gulab Devi Chest Hospital
58. United Christian Hospital, Lahore
59. The Children's Hospital & Institute of Child Health

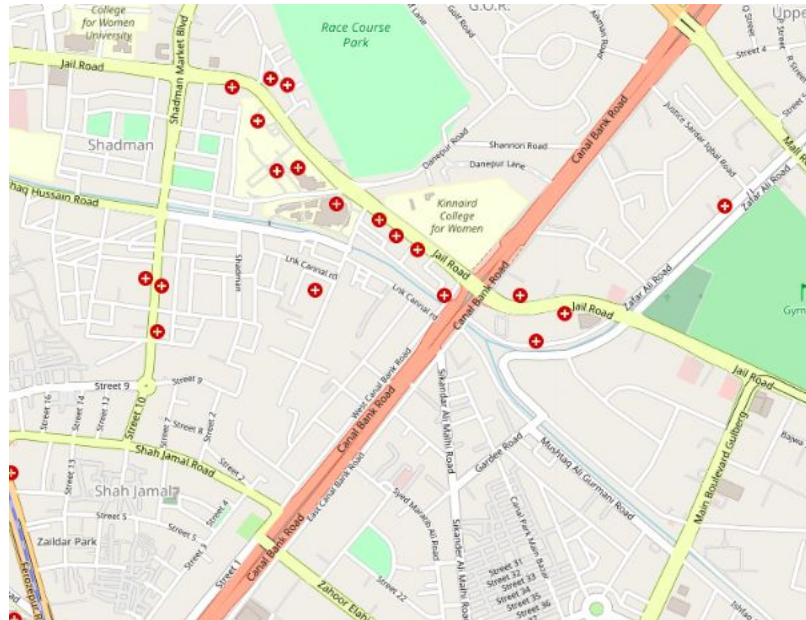
60. Jinnah Hospital
61. Lady Aitchison Hospital
62. Lady Willingdon Hospital
63. Lahore General Hospital
64. Mayo Hospital
65. Nawaz Sharif Social Security Hospital, Multan Road
66. Pakistan Kidney and Liver Institute and Research Center, Opposite DHA Phase 6, Lahore, Pakistan
67. Punjab Institute of Cardiology
68. Punjab Social Security Hospital
69. Railway Karen Hospital
70. Services Hospital
71. Punjab Institute of Mental Health
72. Shaikh Zayed Hospital
73. Sir Ganga Ram Hospital
74. Janki Devi Hospital
75. Wapda Hospital
76. Punjab Institute of Neurosciences Ferozepur Road Lahore.
77. Nawaz Sharif Hospital Kot Khawja Saeed Lahore.
78. Social Security Hospital, Kotlakhpat, Ferozpur Road, Lahore

Using Folium, we were easily able to map the marker points of the hospitals within the areas of Lahore, a partial screenshot of the following shows the concentration of hospitals within certain areas:



Area around Shah Kamal and Pakki Thatti is relatively devoid of good healthcare facilities near them. The markers clearly show that the areas are surrounded with scarce healthcare facilities, but there is no hospital that may be able to cater the needs of the people within the vast area of the two colonies. Another

area, Nawan Kot and Samanabad, are also within the frame but they are nearer to the healthcare facilities provided in the area, and hence can be excluded from the areas with high scarcity.



In contrast areas such as Jail Road are highly populated with hospital and healthcare facilities. In fact, it is more densely populated with hospitals than any other area in the city. Such areas would mean that there is high competition within the hospitals in order to cater to more patients, and hence is predominantly populated by private institutions. A public hospital here would not only be a waste of resources but also would go out of business very soon, since people once offered the opportunity would prefer private institutions for medical care rather than public hospitals.

Using this rubric, several different points were analyzed and various avenues were explored in order to understand the relationship of high number of healthcare facilities being provided in accordance to the area where they are situated. It was noted that areas having a known history of being “posh” areas are more likely to have more hospitals than areas which are still relatively rural.

Results and discussion

As per our initial hypothesis, we have seen that there are a number of areas that are greatly devoid of healthcare facilities within some areas, whereas other areas have ample amount of healthcare facilities sometimes unnecessarily close to one another. Using the longitudinal and latitudinal locations of areas, along with mapping various hospitals within the area using folium library, we were able to confirm our observations. The areas that were identified to be potentially low on healthcare facilities are:

- Shah Kamal
- Pakki Thatti
- Gulshan Ravi
- Harbanspura

- Mehmood Booti
- Gurawala Colony

The healthcare facilities provided to Shah Kamal and Pakki Thatti can be shared since the two areas are in close proximity to each other. However, Mehmood Booti, Gurawala Colony and Gulshan Ravi will require to have their own dedicated hospitals in order to cater the needs of the citizens in those areas.

Conclusion

Healthcare facilities are an important factor for any budding community. However, many areas do not get proper medical care due to lack of facilities, and governments need to make decisions in order to effectively position areas where to create public facilities that can be of use to everyone. Although this experiment was on a relatively smaller scale, it can be further explored to pinpoint the exact coordinates where the hospitals or other public facilities may be built. This would not only help the people but also help the government in making rational decisions for effective governance.