
# JAKARTA'S MEDICAL CENTERS

## FINDING THE BEST LOCATION TO BUILD NEW MEDICAL CENTERS IN JAKARTA

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8/13/20

COURSERA CAPSTONE PROJECT

# Table of Contents

# Table of Figures

# 1. INTRODUCTION

Indonesia is the largest archipelago in the world with an estimated total of 17 504 islands. The country is ranked fourth globally in terms of population, with a population of more than 240 million. Indonesia has experienced an increase in health infrastructure, including primary and referral health facilities, in the last two decades. Inpatient beds in both public and private hospitals and primary health centres have also increased. However, the ratios of both hospital to population remain below WHO standards and lag behind other Asia-Pacific countries. In addition, there are varying conditions and quality of the medical facilities over the country.

The best medical facilities are mostly found in big cities such as Jakarta. Jakarta is Indonesia's capital and the most populated city in the country with more than 10 million population. Despite having the most medical centres in country, Jakarta's medical facilities are far from adequate. The hospitals, especially the public ones, tend to be overcrowded and waiting times will be long. The city definitely needs more medical facilities in order to increase the well-being of its people.

This project aims to find the best districts to build new medical centres in Jakarta by considering the number of existing medical centres available within those districts and the total population. This project may help Jakarta's Government to make better decisions to improve Jakarta's health system by prioritizing districts where medical centres are lacked. This project may also beneficial for investors who are planning to build new medical centres in Jakarta.

# 2. DATA

The main data used in this project are the location of existing medical centres on each district which are generated from Foursquare using API. The Foursquare API needs coordinates data of each district to find medical centres around. The list of Jakarta's districts is taken from kodeposresmi.com while the coordinate data are taken from Statistics Indonesia's website (bps.go.id). Here is the sneak peak of the data used to generate the list of medical centres in Jakarta:

| Municipalities | Districts | Latitude | Longitude |
|---|---|---|---|
| Kabupaten Kepulauan Seribu | Kepulauan Seribu Selatan | -5.926341 | 106.633551 |
| Kabupaten Kepulauan Seribu | Kepulauan Seribu Utara | -5.478190 | 106.548259 |
| Kota Jakarta Barat | Cengkareng | -6.148665 | 106.735258 |
| Kota Jakarta Barat | Grogol Petamburan | -6.162275 | 106.788342 |
| Kota Jakarta Barat | Kalideres | -6.134294 | 106.705773 |

Figure 1. Districts and Coordinates Data

Using Foursquare API's explore function we can get the list of medical centres including their names, subcategories, and coordinates. This project will focus on general medical centres, therefore specialized medical facilities like veterinarian and acupuncturist are excluded from the list.

| District | District Latitude | District Longitude | Medical Center Name | Category | MC Latitude | MC Longitude |
|---|---|---|---|---|---|---|
| Cengkareng | -6.148665 | 106.735258 | Klinik Dr Hamid Handoyo Suryo | Medical Center | -6.146981 | 106.735607 |
| Cengkareng | -6.148665 | 106.735258 | BKM St.Carolus Cengkareng | Doctor's Office | -6.147905 | 106.736217 |
| Grogol Petamburan | -6.162275 | 106.788342 | Rumah sakit Hermina | Medical Center | -6.164363 | 106.789669 |
| Grogol Petamburan | -6.162275 | 106.788342 | Klinik Kecantikan Dr. Mulyana | Doctor's Office | -6.161576 | 106.789157 |
| Grogol Petamburan | -6.162275 | 106.788342 | Puspa Skin & Slimming Center | Medical Center | -6.159850 | 106.791722 |

Figure 2. Medical Centres Data from Foursquare

For better decision making, the population data are also used to find districts with the lowest rate of medical centres per population. The population data are taken from Statistics Indonesia's website (bps.go.id).

# 3. METHODOLOGY

*K-means* method is used to cluster the districts. Clustering the districts help us to find potential district group which fall into our criteria and understand how those groups differ from the others.

Before performing *K-means,* the data need to be transformed in order to create a better model. Instead of using the raw data generated from Foursquare, a new pivot table is created. It contains the number of medical centre by subcategories in each district. A new feature called MC per Population is also included. All variables are then rescaled to help *K-means* performs better.

| Districts | Doctor's Office | Hospital | Medical Center | MC per Population |
|---|---|---|---|---|
| Kepulauan Seribu Selatan | 0.0 | 0.0 | 0.0 | 0.000000 |
| Kepulauan Seribu Utara | 0.0 | 0.0 | 0.0 | 0.000000 |
| Cengkareng | 1.0 | 0.0 | 1.0 | 0.000003 |
| Grogol Petamburan | 2.0 | 8.0 | 2.0 | 0.000050 |
| Kalideres | 1.0 | 0.0 | 1.0 | 0.000004 |

Figure 3. Data for Clustering

*K-means* with two clusters are performed after data are transformed. To understand the two clusters better, the summary data of each cluster are analysed. The cluster with lower number of medical centres and MC per Population rate are chosen as the potential districts. After selecting the potential group, the existing medical centres of each district in the group is plotted in using density-based heatmap. The districts which are the furthest from the existing medical centres will be chosen as the final potential districts.

# 4. RESULTS

*K-Means* is performed and two clusters are generated. Below are the summary data of each cluster :

```
Cluster                 0
Doctor's Office         3.500000
Hospital                4.000000
Medical Center          4.500000
MC per Population       0.000094

Cluster                 1
Doctor's Office         0.416667
Hospital                0.694444
Medical Center          0.888889
MC per Population       0.000010
```

Districts in cluster 1 generally have lower number of medical centres and MC per Population compared to districts in cluster 0. Therefore, districts in cluster 1 are chosen as the potential districts to build new medical centres. There are 43 districts are in cluster 1, including Kepulauan Seribu Selatan, Cengkareng, and Tanjung Priok.

To get better insight, existing medical centres for each district are plotted using density based heatmap.

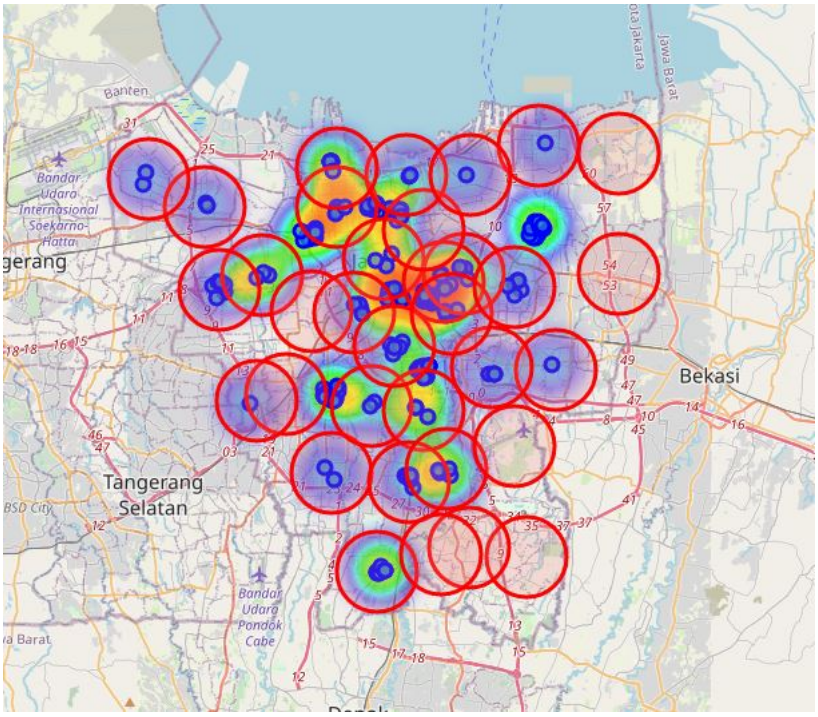


Figure 4. Existing Medical Centres Map

The districts that are located the furthest from existing medical centres are : Kepulauan Seribu Selatan, Kepulauan Seribu Utara, Cilincing, Cakung, Ciracas and Cipayung. Those districts are chosen as our final potential districts.

# 5. DISCUSSION

If we need to find only one district as the optimal location to build a new medical centre then Kepulauan Seribu Selatan or Kepulauan Seribu Utara is the perfect choice as it is located the furthest from existing medical centres. However, if the investor prefers to build a new medical centre in the mainland then Cakung can be a perfect choice since it has more population than the rest.

Some further data analysis by considering economical and environmental factors may be required to find the best district for the new medical centre.

# 6. CONCLUSION

Despite having the best medical facilities in the country, the number of Jakarta's medical facilities are far from adequate. New medical centres are need to be built in order to increase the well-being of its people. After performing analysis using K-means clustering and density-based heatmap, we found that the potential locations to build new medical centres are Kepulauan Seribu Selatan, Kepulauan Seribu Utara, Cilincing, Cakung, Ciracas and Cipayung. The optimal location among those potential districts is Kepulauan Seribu Selatan or Kepulauan Seribu Utara. However, if the investor prefers to build a new medical centre in the mainland then Cakung can be a perfect choice.