

**DETECTING NEARBY HOSPITAL VENUES  
FOR MEDICAL EMERGENCIES AND  
FINDING COVID-19 SEVERITY IN  
TAMILNADU DISTRICTS**

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Coursera Capstone Project

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# INTRODUCTION

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The swift spreading of the novel corona virus COVID-19 had brought the entire world to a stand-still. Researchers had suggested that its repercussions are still premature and yet to be realized completely. This pandemic has caught the entire world on tenterhooks. Scientists world over are running against time to develop an anti-body for this COVID-19 that would bring a cure and curtail its further advancements.

Finding nearby hospitals based on current location (Latitude, Longitude) in case of medical emergencies for the patients is vital. To condense these odds of happening, a health care category finder that would extract nearby locations of medical centers is important for providing medical emergencies on demand.



# Problem Insights

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**The major Insights influenced in the problem are,**

- Suggests the number of prevailing hospitals in the neighborhood areas
- Distance to the neighborhood hospitals from the current location
- Grouping of similar districts based on covid-19 cases where utmost care has to be taken

# DATA DESCRIPTION

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- Latitude and Longitude Dataset of Tamil Nadu state will be obtained from the **URL:** [https://www.mapsofindia.com/lat\\_long/tamilnadu/](https://www.mapsofindia.com/lat_long/tamilnadu/)
- This dataset comprises of the following columns:
  - ✓ **Location:** District Name(s) of TN
  - ✓ **Latitude:** Latitude data of the District (DMS Format\*)
  - ✓ **Longitude:** Longitude data of the District (DMS Format\*)

\*DMS Format: (° : degree, ' : minute, " : second)+Direction(N,E,W,S)

# DATA DESCRIPTION

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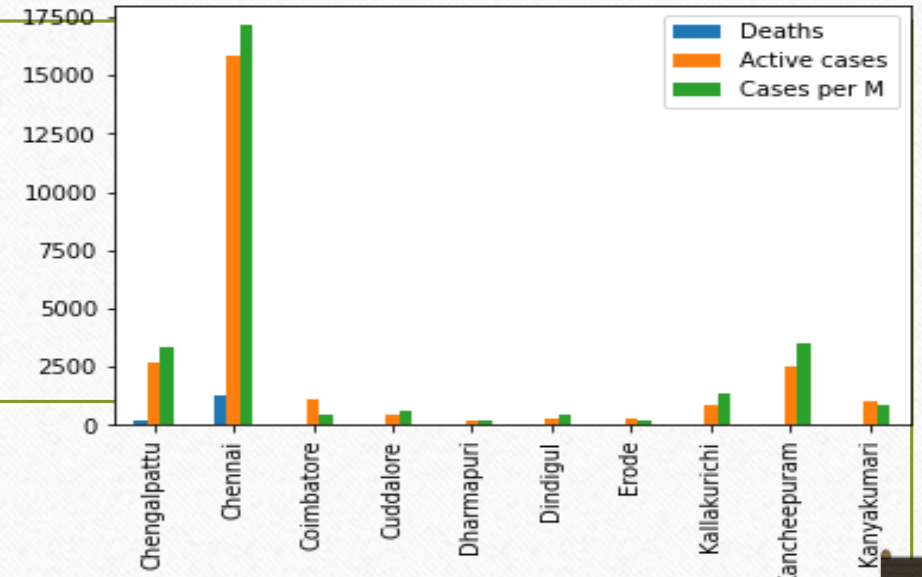
- COVID-19 pandemic data of Tamil Nadu, India medical cases by district will be obtained from the  
**URL:**[https://en.m.wikipedia.org/wiki/Template:COVID19\\_pandemic\\_data/India/Tamil\\_Nadu\\_medical\\_cases\\_by\\_district](https://en.m.wikipedia.org/wiki/Template:COVID19_pandemic_data/India/Tamil_Nadu_medical_cases_by_district)
- This dataset comprises of the following columns:
  - **District:** TN District Name
  - **Diagnosed cases:** Total No. of Diagnosed cases for COVID-19
  - **Deaths:** Total No. of Deaths caused by COVID-19
  - **Recovered cases:** Total No. of Recovered cases from COVID-19
  - **Active cases** : Total No. of COVID-19 cases still active
  - **Population:** Total population of the District
  - **Cases per M:** Cases per Million
  - **Last case reported on:** Last reported date



# DATA COLLECTION

## COVID-19 pandemic data (Web Scrapping)

	District	Diagnosed cases	Deaths	Recovered cases	Active cases	Population	Cases per M	Last case reported on
0	District	Diagnosed cases[a]	Deaths	Recovered cases	Active cases[b]	Population	Cases per M	Last case reported on
1	Tamil Nadu	102,721	1,385	58,378	42,955	75,695,000	1,357	3 July 2020
2	Ariyalur	463	0	425	38	752,481	615	1 July 2020
3	Chengalpattu	6,139	106	3,113	2,920	2,556,423	2,401	3 July 2020
4	Chennai	64,689	996	40,111	23,582	7,088,000	9,127	3 July 2020



# DATA COLLECTION

Latitude and Longitude Data of TN Districts

	Active	Location	Latitude	Longitude
0	1	Ariyalur	11° 8' N	79° 4' E
1	1	Chengalpattu	12° 42' N	80° 01' E
2	1	Chennai	13° 04' N	80° 17' E
3	1	Coimbatore	11° 00' N	77° 00' E
4	1	Cuddalore	11° 43' N	79° 49' E

# Convert DMS (degrees-minutes-seconds) to DD (decimal degrees) Coordinates

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	Active	Location	Latitude	Longitude	DD_Lat	DD_Lng
<b>0</b>	1	Ariyalur	11° 8' N	79° 4' E	11.133333	79.066667
<b>1</b>	1	Chengalpattu	12° 42' N	80° 01' E	12.700000	80.016667
<b>2</b>	1	Chennai	13° 04' N	80° 17' E	13.066667	80.283333
<b>3</b>	1	Coimbatore	11° 00' N	77° 00' E	11.000000	77.000000
<b>4</b>	1	Cuddalore	11° 43' N	79° 49' E	11.716667	79.816667



# Current location Coordinates extraction using geocoder API

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```
address = 'Alwarpet, Chennai, Tamilnadu'
```

```
geolocator1 = Nominatim(user_agent="ny_explorer")
```

```
location1 = geolocator1.geocode(address)
```

```
latitude1 = location1.latitude
```

```
longitude1 = location1.longitude
```

```
print("The geograpical coordinate of {} are {}, {}".format(address,latitude1, longitude1))
```

**The geograpical coordinate of Alwarpet, Chennai, Tamilnadu are *13.0338602, 80.2545491*.**

# FourSquare API Credentials including category

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LIMIT = 100

radius = 2000

url = 'https://api.foursquare.com/v2/venues/explore?&categoryId={} &client\_id={} &client\_secret={} &v={} &ll={},{} &radius={} &limit={} '.

format(

CATEGORY\_ID,

CLIENT\_ID,

CLIENT\_SECRET,

VERSION,

latitude1,

longitude1,

radius,

LIMIT)

# Neighborhood hospital data returned by FourSquare API

nearby_venues.head(100)					
		name	categories	lat	lng
0		kauvery hospital	Hospital	13.038214	80.257067
1		Balaji Dental & Craniofacial Hospital	Dentist's Office	13.035352	80.247048
2		Apollo Speciality Hospital	Hospital	13.033841	80.245289
3	ALL SMYLES COSMETIC DENTAL CENTRE CHENNAI INDIA		Dentist's Office	13.033604	80.250548
4		SKS Veterinary Hospital	Hospital	13.028984	80.258728
5		Madras ENT Research Foundation	Hospital	13.027266	80.254176
6		St. Isabel's Hospital	Hospital	13.039236	80.262297
7		Oliva Skin and Hair Clinic Alwarpet	Hospital	13.042096	80.259281
8		Sankara Nethralaya	Hospital	13.026432	80.261102
9		Dr. Agarwal's Eye Hospital	Hospital	13.046304	80.255363
10		Bharathiraja Hospital	Hospital	13.048036	80.245013
11		Seethapathy Clinic and Hospital	Hospital	13.048841	80.264537



# Calculating Distance for the hospitals extracted



```
nearby_venues.head()
```



	name	categories	lat	lng	Distance
3	ALL SMYLES COSMETIC DENTAL CENTRE CHENNAI INDIA	Dentist's Office	13.033604	80.250548	0.434329
0	kauvery hospital	Hospital	13.038214	80.257067	0.555733
4	SKS Veterinary Hospital	Hospital	13.028984	80.258728	0.706312
5	Madras ENT Research Foundation	Hospital	13.027266	80.254176	0.734405
1	Balaji Dental & Craniofacial Hospital	Dentist's Office	13.035352	80.247048	0.829344

# Clustering based on distance and adding cluster labels to the dataset



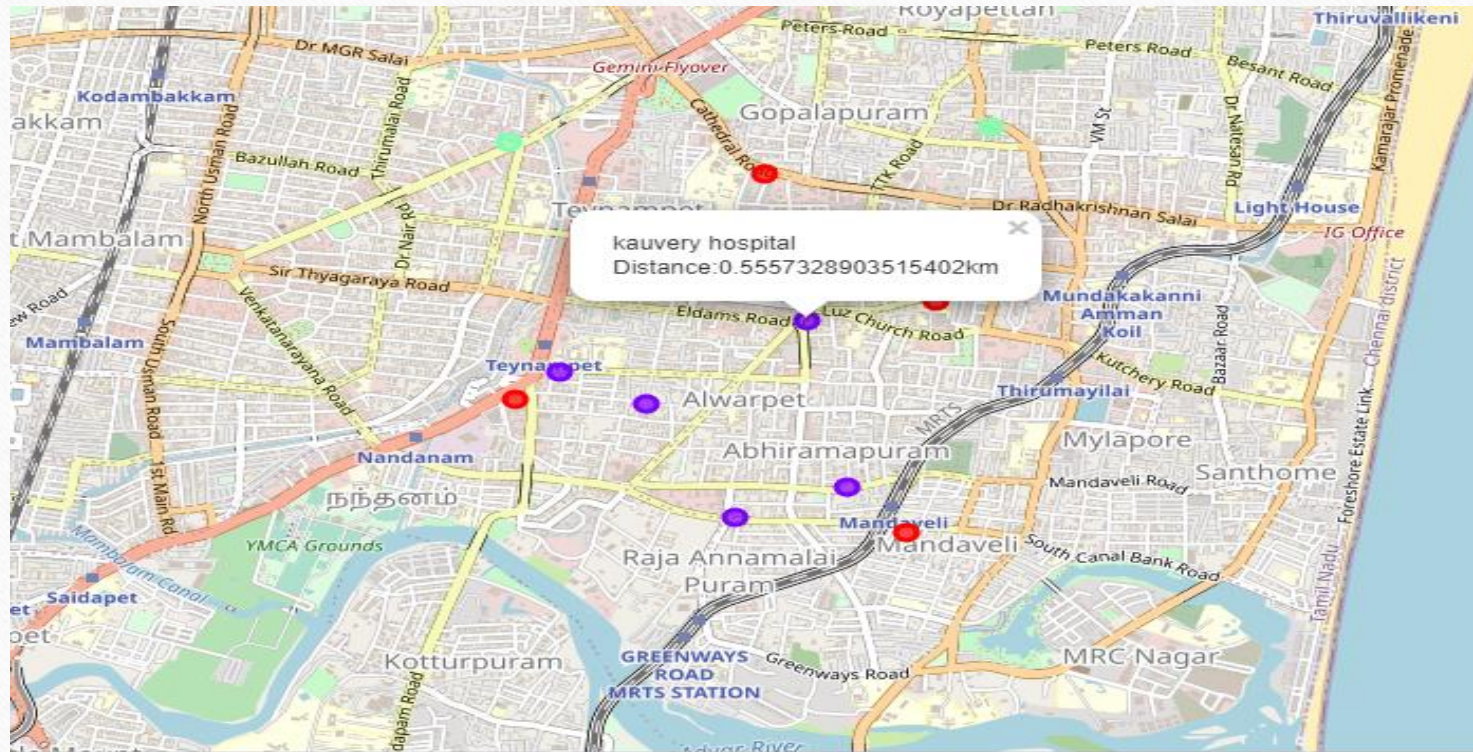
```
nearby_venues.tail()
```



	Cluster Labels	name	categories	lat	lng	Distance
7	2	Oliva Skin and Hair Clinic Alwarpet	Hospital	13.042096	80.259281	1.049481
8	2	Sankara Nethralaya	Hospital	13.026432	80.261102	1.089126
9	2	Dr. Agarwal's Eye Hospital	Hospital	13.046304	80.255363	1.386506
10	1	Bharathiraja Hospital	Hospital	13.048036	80.245013	1.884593
11	1	Seethapathy Clinic and Hospital	Hospital	13.048841	80.264537	1.986330



# Mapping Clustered Coordinates





# Clustering severity of COVID-19 impact on TN Districts

## Merged Dataset

	Active	Location	Latitude	Longitude	DD_Lat	DD_Lng	District	Diagnosed cases	Deaths	Recovered cases	Active cases	Population	Cases per M	Last case reported on
0	1	Chengalpattu	12° 42' N	80° 01' E	12.700000	80.016667	Chengalpattu	6,139	106	3,113	2,920	2,556,423	2,401	3 July 2020
1	1	Chennai	13° 04' N	80° 17' E	13.066667	80.283333	Chennai	64,689	996	40,111	23,582	7,088,000	9,127	3 July 2020
2	1	Coimbatore	11° 00' N	77° 00' E	11.000000	77.000000	Coimbatore	645	1	252	392	3,172,578	203	3 July 2020
3	1	Cuddalore	11° 43' N	79° 49' E	11.716667	79.816667	Cuddalore	1,143	5	813	325	2,600,880	439	3 July 2020
4	1	Dharmapuri	12° 08' N	78° 13' E	12.133333	78.216667	Dharmapuri	107	0	41	66	1,502,900	71	3 July 2020
5	1	Dindigul	10° 22' N	78° 00' E	10.366667	78.000000	Dindigul	618	7	310	301	2,161,367	286	3 July 2020

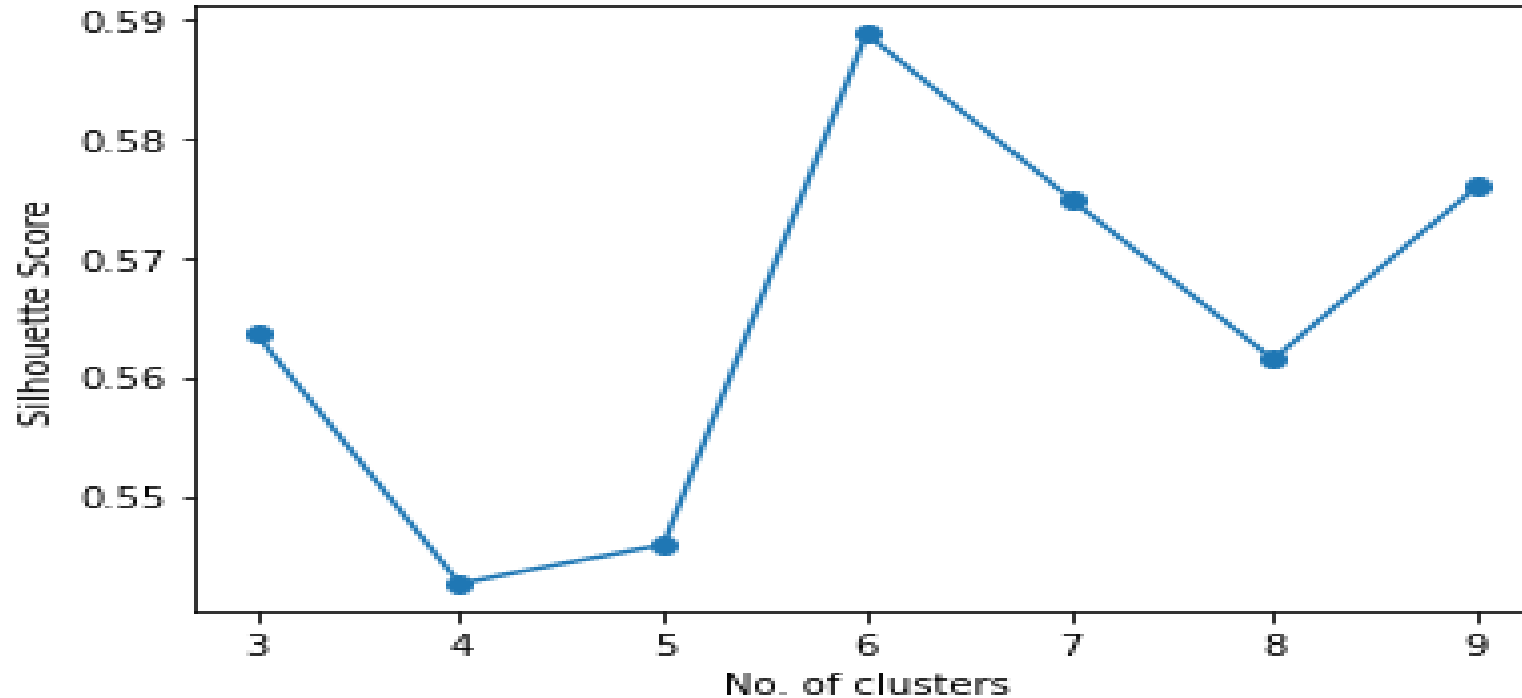
# Adding cluster labels to the Dataset

```
▶ Merge_df.head()
```



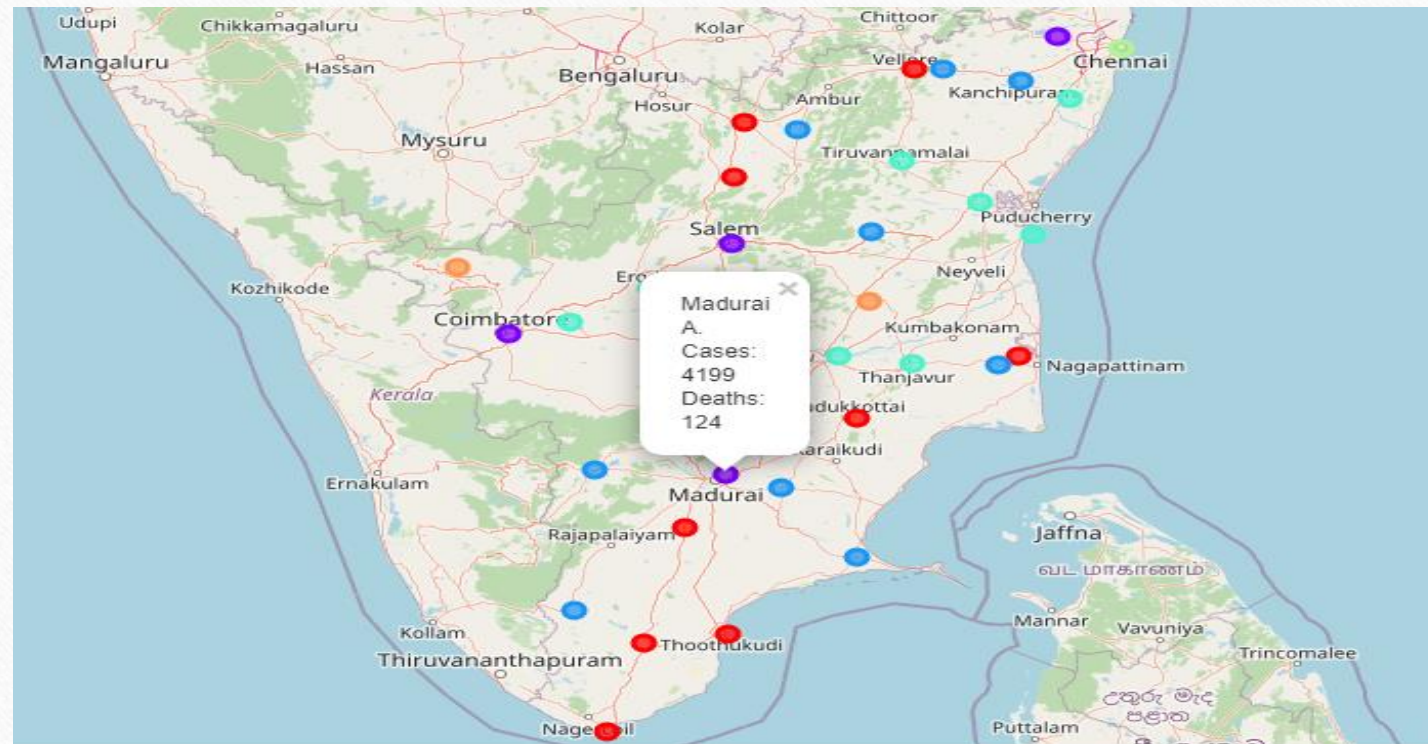
	Cluster Labels	Active	Location	Latitude	Longitude	DD_Lat	DD_Lng	District	Diagnosed cases	Deaths	Recovered cases	Active cases	Population	Cases per M	Last case reported on
0	3	1	Chengalpattu	12° 42' N	80° 01' E	12.700000	80.016667	Chengalpattu	8553	169	5695	2689	2556244	3346	14 July 2020
1	4	1	Chennai	13° 04' N	80° 17' E	13.066667	80.283333	Chennai	79662	1295	62552	15815	4646732	17144	14 July 2020
2	1	1	Coimbatore	11° 00' N	77° 00' E	11.000000	77.000000	Coimbatore	1480	10	338	1132	3458045	428	14 July 2020
3	3	1	Cuddalore	11° 43' N	79° 49' E	11.716667	79.816667	Cuddalore	1565	6	1154	405	2605914	601	14 July 2020
4	0	1	Dharmapuri	12° 08' N	78° 13' E	12.133333	78.216667	Dharmapuri	260	1	103	156	1506843	173	14 July 2020

# Optimal number of clusters by Silhouette metric





# Clustering TN Districts based on COVID-19 Severity (K=6)



# DISCUSSIONS-Finding Near by hospital Venues

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- The first cluster (Cluster label 0) has the hospitals situated less than 1 km from the chosen location *Alwarpet*.
- Cluster 2 (Cluster label 2) is the cluster, where we see list of the list of hospitals situated (1 km approx).
- Cluster 3 (Cluster label 1) contains hospitals situated more than 1.5 km from the given location.
- The table shows that five hospitals ( $<1$  km) which is closer to the given location, two hospitals are located ( $>1.5$  km) and five hospitals are located ( $\approx 1$  km) for the given radius (2000) in the foursquare API.



# DISCUSSIONS-COVID-19 impact over TN districts

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- The optimal number of classes ( $k=6$ ) is obtained through silhouette metric.
- The first cluster (Cluster label 0) the biggest one has 10 districts and the second cluster has (Cluster label 1) has 4 districts grouped together based on the COVID-19 identified cases.
- The third cluster (Cluster label 2) another biggest cluster has 10 districts and the fourth cluster has (Cluster label 3) has 9 districts grouped together based on the COVID-19 identified cases.
- The fifth cluster (Cluster label 4) being the smallest cluster, it has only 1 district (Capital of TN: Chennai). This district forms a distinct cluster, because the particular district is highly affected by COVID-19 virus because of its dense population and increasing cases day by day. The sixth cluster has (Cluster label 5) has 2 districts (Perambalur & Nilgiris) grouped together, these districts have the minimum number of COVID-19 identified cases.



# CONCLUSION

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Rural communities have extended struggled to maintain right to use to quality health care facilities. During the pandemic time, entire country is affected irrespective of rural and the urban areas because of rapid spreading of diseases. The urban class people gets immediate treatment as more hospitals are sited. A diversity of elements contribute to the problems in the rural areas such as shortages of physicians, casualty facilities, underinsured residents and so on. This project helps government and the health care organizations to identify areas where utmost care has to be taken and provide on-time medical facilities for the needy. The grouping of districts based on the severity of virus spreading helps health organizations in developing new approaches to support rural communities to deliver high-quality, cost-effective medical services on demand.