PADM 841-401

Public Data Analysis

Project Report

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Introduction

This report is to assess and visualize the number of Health Centers available in India, per state in the year of 2016 (Till March 31st). Also to visualize if there is any relationship between the number of health centers and the state wise area or population using JMP.

Literature Review and Data Collection

The data has been collected from the Open Government Data (OGD) Platform India and Wikipedia. I have studied the type of health centers and how they actually help the people in the country. I have reviewed the OGD website and few google articles to collect the artifacts about the data.

Data

- ★ The original data was a collection of three excel sheets:
    1) Health Centers District Wise till March 2016 in India
    2) India Census 2011
    3) State wise Area till March 2016 in India

- ★ The data is cleaned using JMP and then joined into a single sheet of relevant attributes.
- ★ Delhi (Union Territory) is the Capital of India.

Assumptions:

- ★ Since the data had been from different years, using the decadal growth (2001 to 2011) rate, values have been predicted for estimated population in 2016.
- ★ Also, it has to be noted that, according to 2011 Census, there are only 28 States and 7 Union Territories. A new state “Telangana” got separated from “Andhra Pradesh” in 2014, which might show some deviations in the calculations.

Statistics on Data

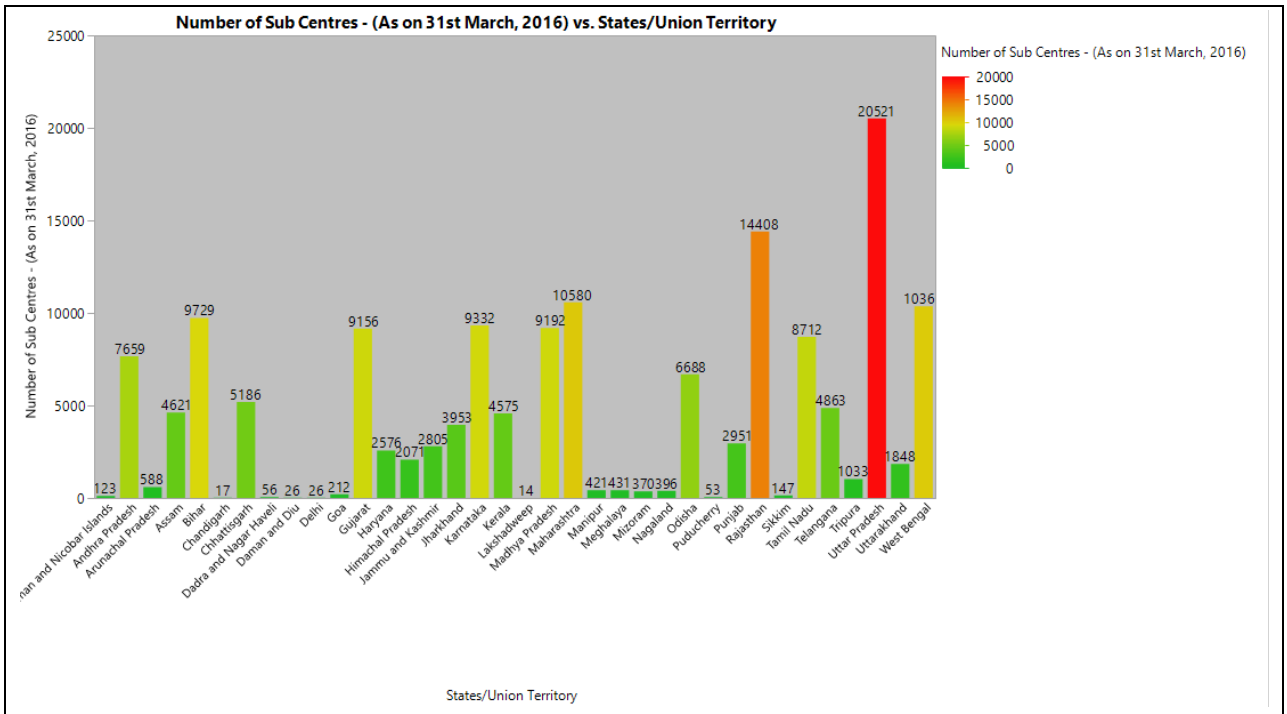
- ★ There are 29 States and 7 Union Territories (36 Total) in India in 2016.
- ★ Types of Health Centers available in India (2016):
    1) Sub-Centers
    2) Primary Health Centers (PHCs)
    3) Community Health Centers (CHCs)
    4) Sub Divisional Hospitals
    5) District hospitals
- ★ Summary of the health centers all over India in 2016 can be as follows:

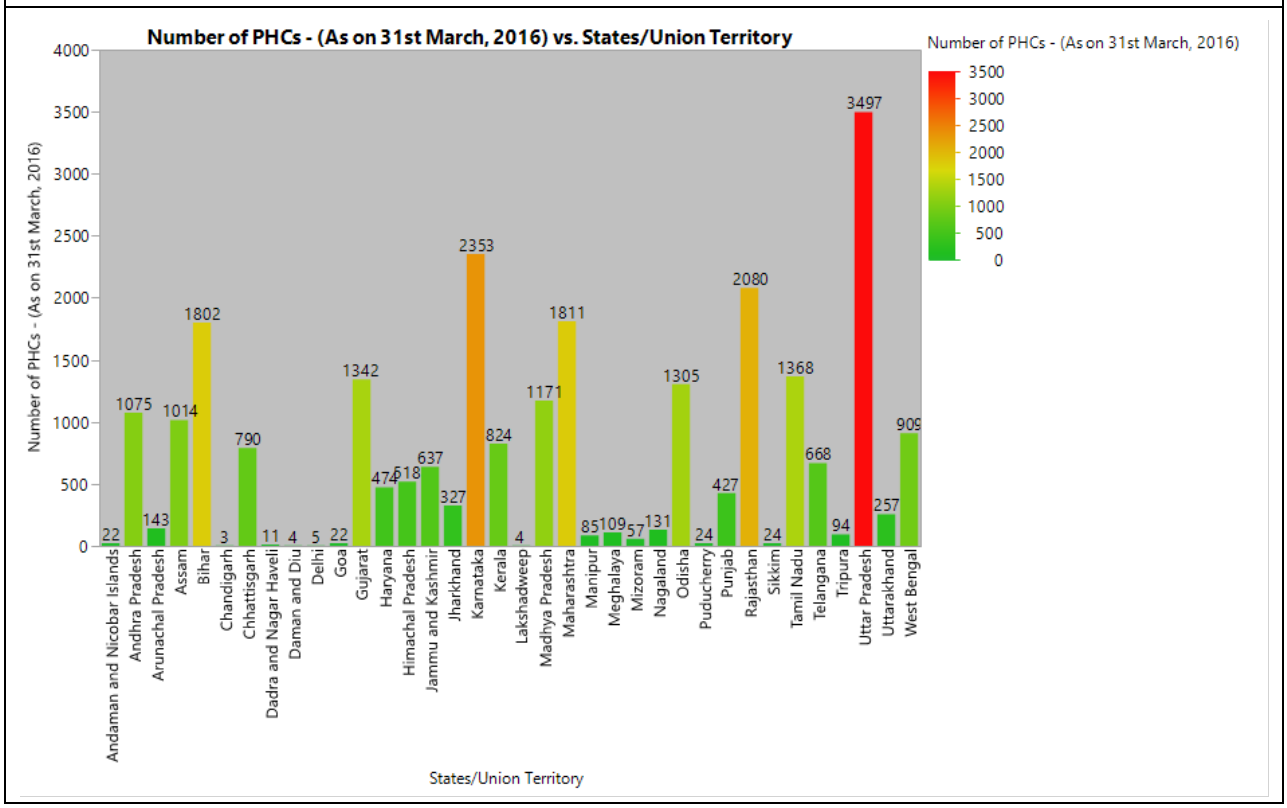
	Total	Average	Least	Max	Missing Values
Sub Centers	155,708	4325.2222	14	20,521	None
PHCs	25,387	705.19444	3	3,497	None
CHCs	5,521	153.36111	0	773	None
Sub Divisional Hospital	1,065	29.58333	0	246	None
District Hospital	773	21.47222	1	160	None

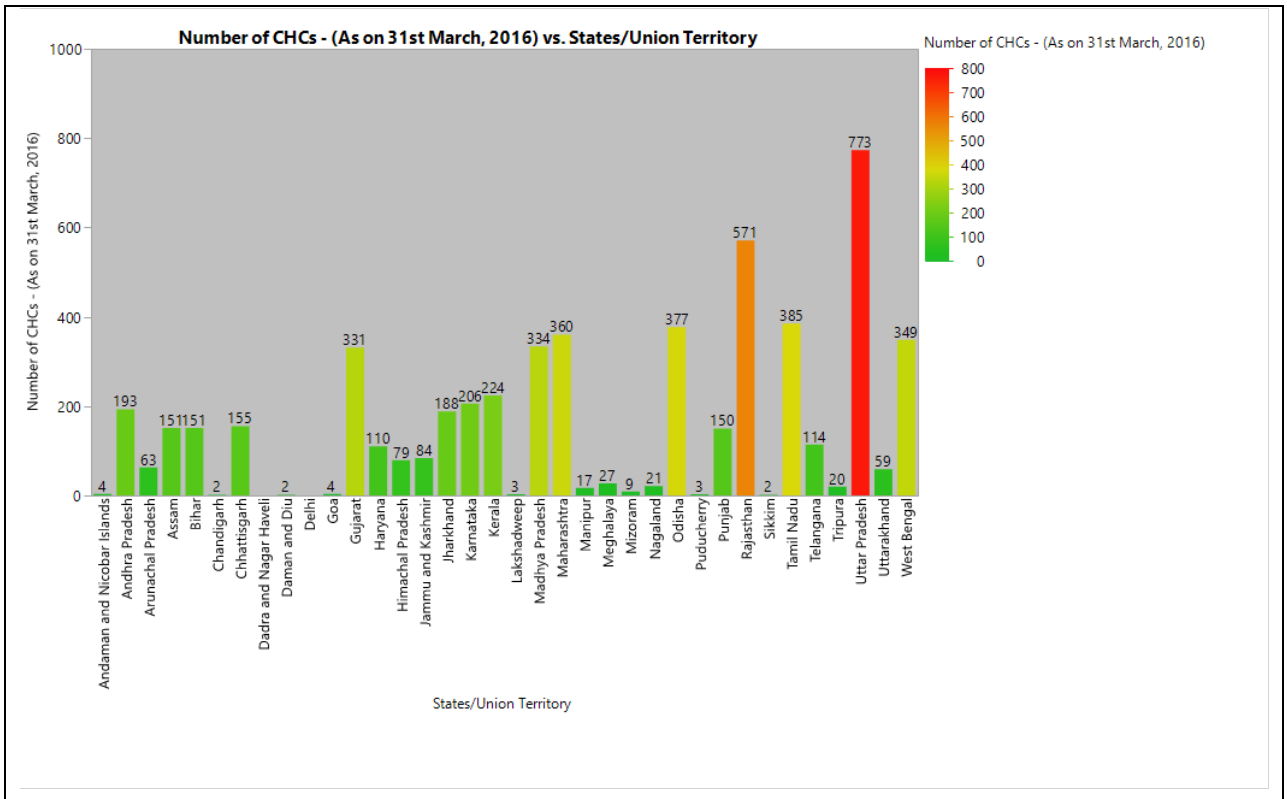
- ★ There are surprisingly zero sub divisional hospitals in 8 places - Andaman and Nicobar, Arunachal Pradesh, Daman and Diu, Jammu and Kashmir, Nagaland, Puducherry, Sikkim, Uttar Pradesh
- ★ Also, there are zero CHCs in 2 places – Dadra and Nagar Haveli, Delhi.
- ★ Total Population of India in 2016 is about 1,296,311,890
- ★ On an average 46,296,853 people stay in a given state in India.
- ★ The total area of India is 3,276,499 Sq. Km in 2016
- ★ On an average 112,982.72 Sq. Km is the land for a state.
- ★ Maximum Population of 219,893,481 is present in Uttar Pradesh State
- ★ Maximum Area (Sq. Km) of 342,239 is occupied by Rajasthan State
- ★ Highly populated state is not the highest area occupied state.

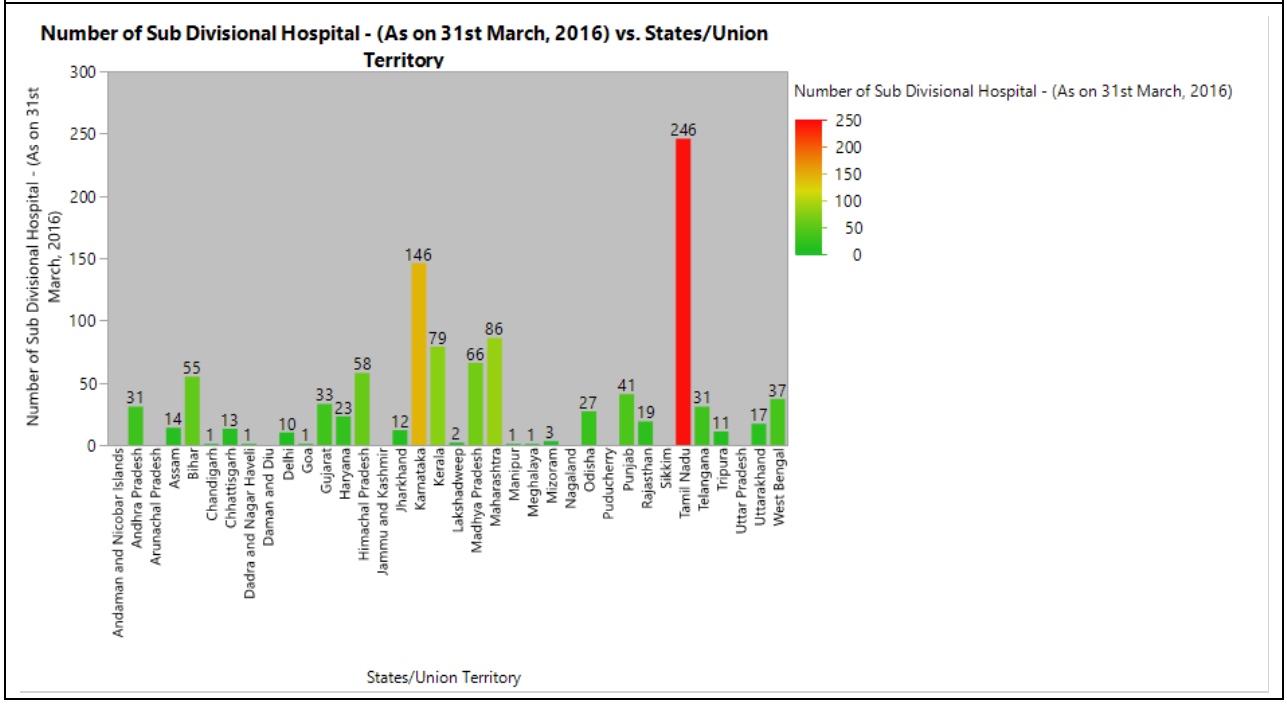
Visualizations

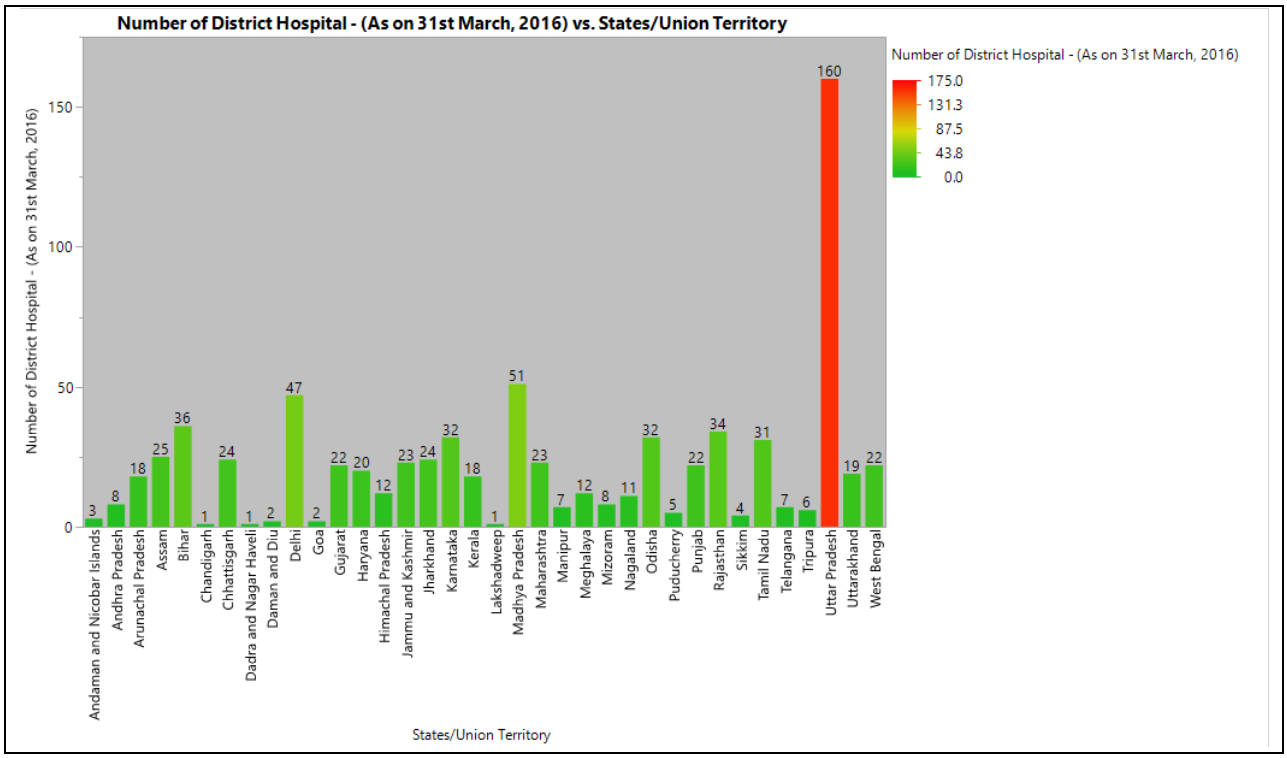
★ Visualizing the Number of **Health Centers** with respect to every place:



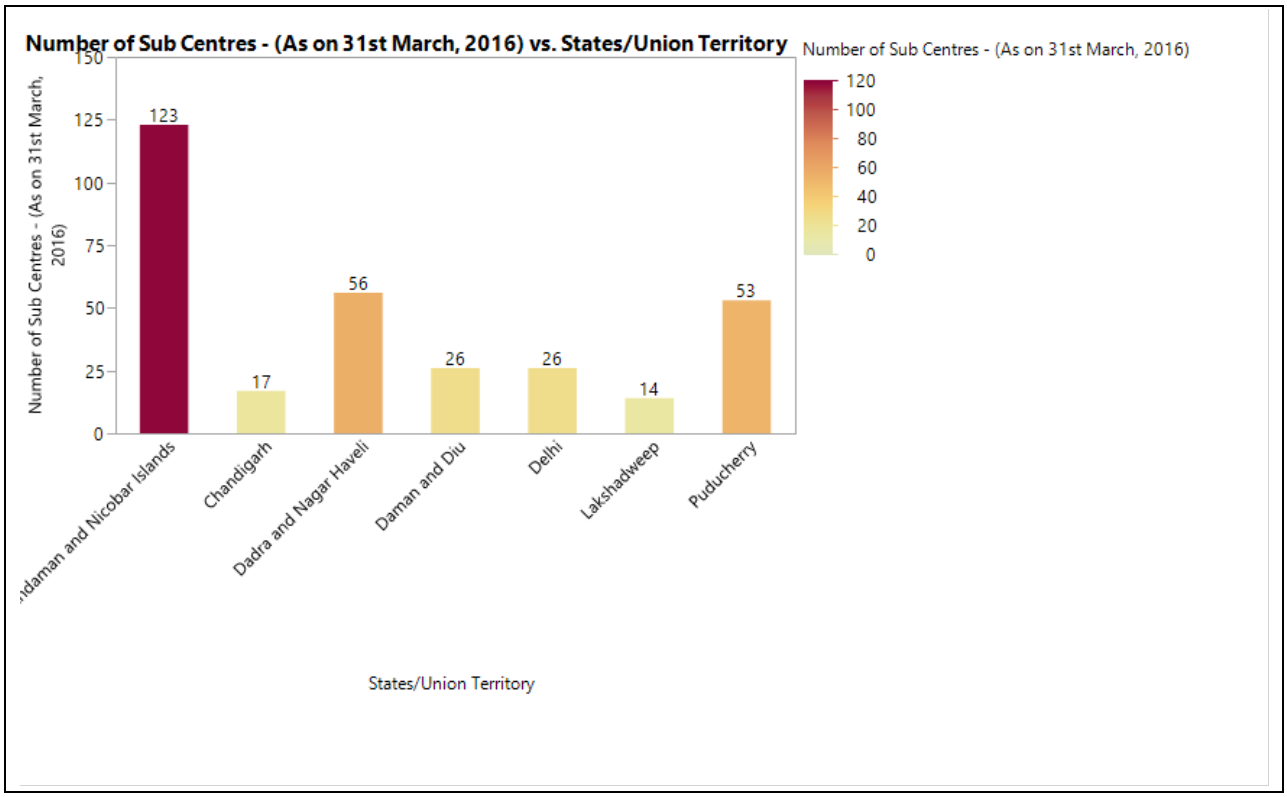


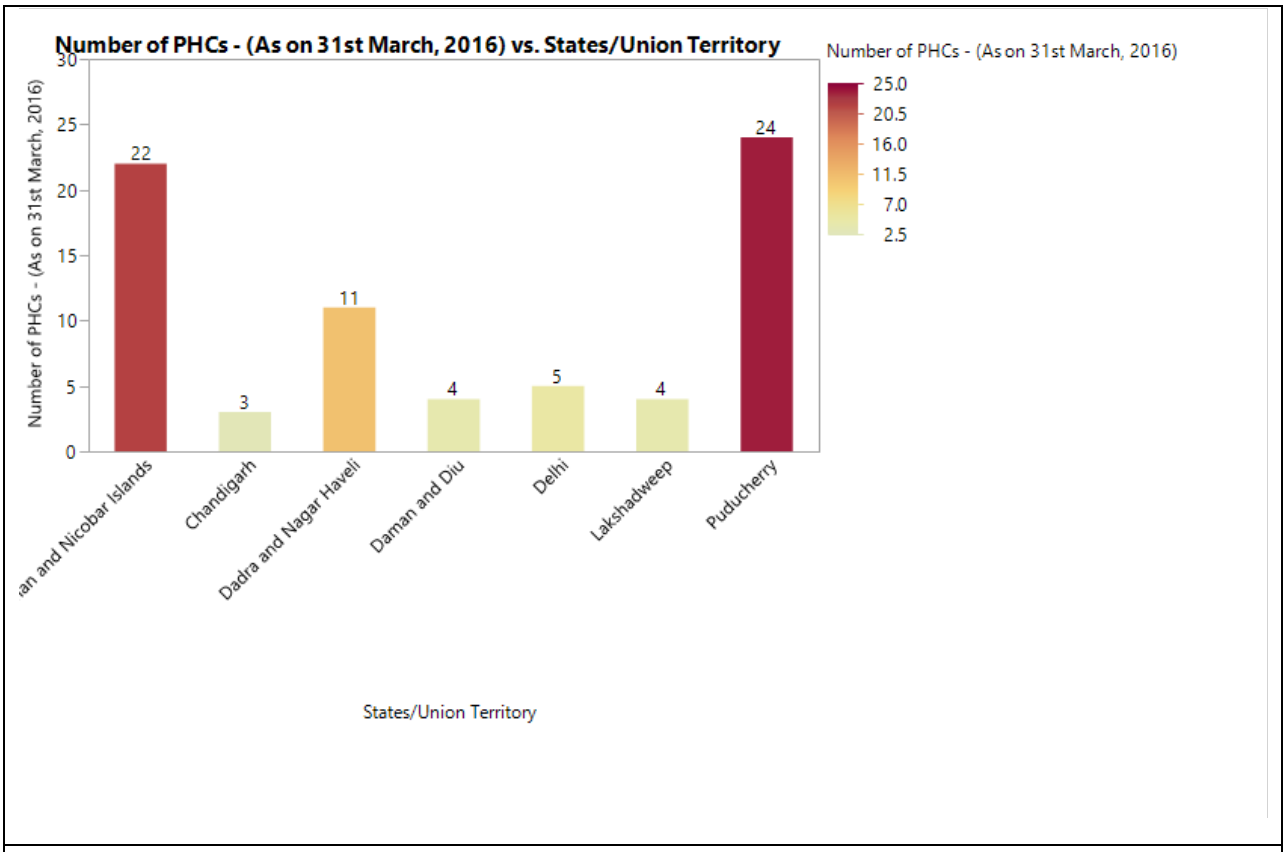

Number of CHCs - (As on 31st March, 2016) vs. States/Union Territory
Number of CHCs - (As on 31st March, 2016)
States/Union Territory
Andaman and Nicobar Islands 4
Andhra Pradesh 193
Arunachal Pradesh 63
Assam 151
Bihar 151
Chandigarh 2
Chhattisgarh 155
Dadra and Nagar Haveli 2
Daman and Diu 2
Delhi 4
Goa 4
Gujarat 331
Haryana 110
Himachal Pradesh 79
Jammu and Kashmir 84
Jharkhand 188
Karnataka 206
Kerala 224
Lakshadweep 3
Madhya Pradesh 334
Maharashtra 360
Manipur 17
Meghalaya 27
Mizoram 9
Nagaland 21
Odisha 377
Puducherry 3
Punjab 150
Rajasthan 571
Sikkim 2
Tamil Nadu 385
Telangana 114
Tripura 20
Uttar Pradesh 773
Uttarakhand 59
West Bengal 349

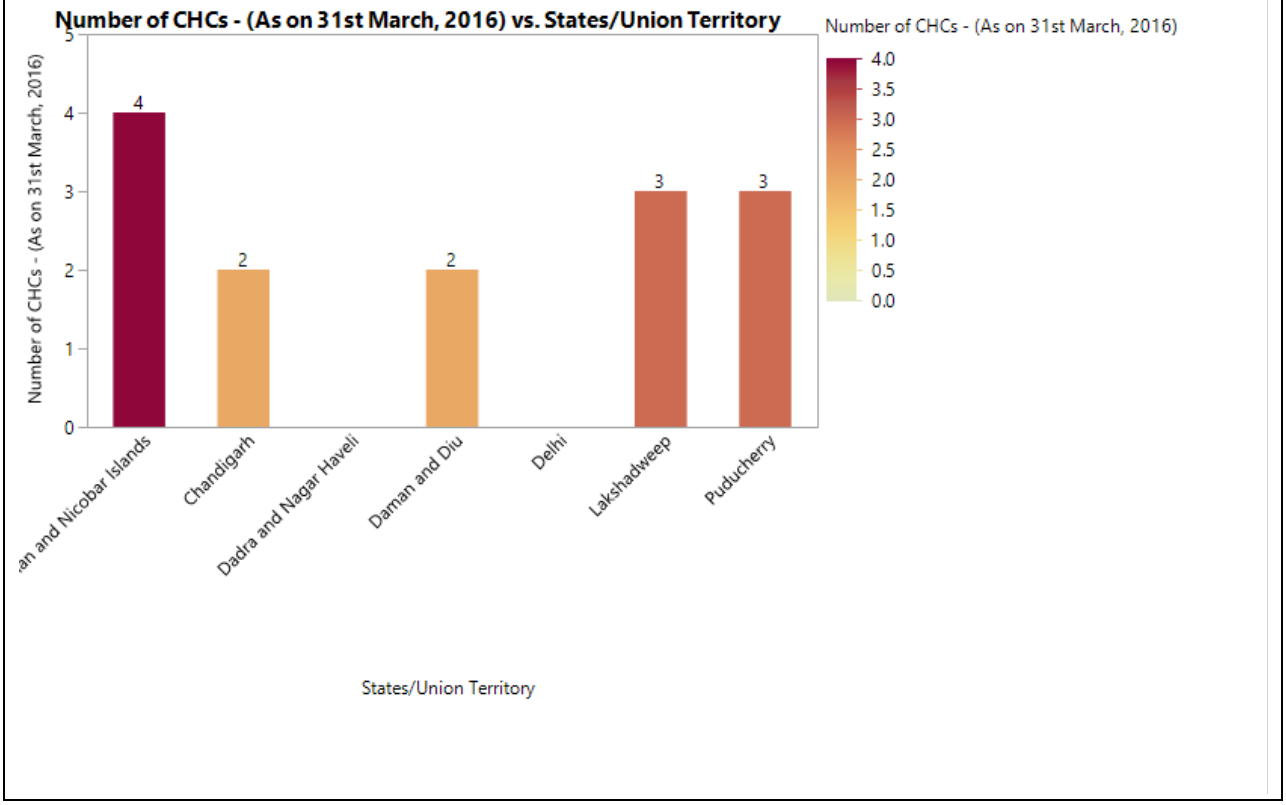

Number of Sub Divisional Hospital - (As on 31st March, 2016) vs. States/Union Territory
Number of Sub Divisional Hospital - (As on 31st March, 2016)
States/Union Territory
Andaman and Nicobar Islands 31
Andhra Pradesh 14
Arunachal Pradesh 55
Assam 1
Bihar 13
Chandigarh 1
Chhattisgarh 1
Dadra and Nagar Haveli 10
Daman and Diu 1
Delhi 33
Goa 23
Gujarat 58
Haryana 12
Himachal Pradesh 146
Jammu and Kashmir 79
Jharkhand 2
Karnataka 66
Kerala 86
Lakshadweep 1
Madhya Pradesh 1
Maharashtra 3
Manipur 27
Meghalaya 41
Mizoram 19
Nagaland 246
Odisha 31
Puducherry 11
Punjab 17
Rajasthan 37
Sikkim
Tamil Nadu
Telangana
Tripura
Uttar Pradesh
Uttarakhand
West Bengal

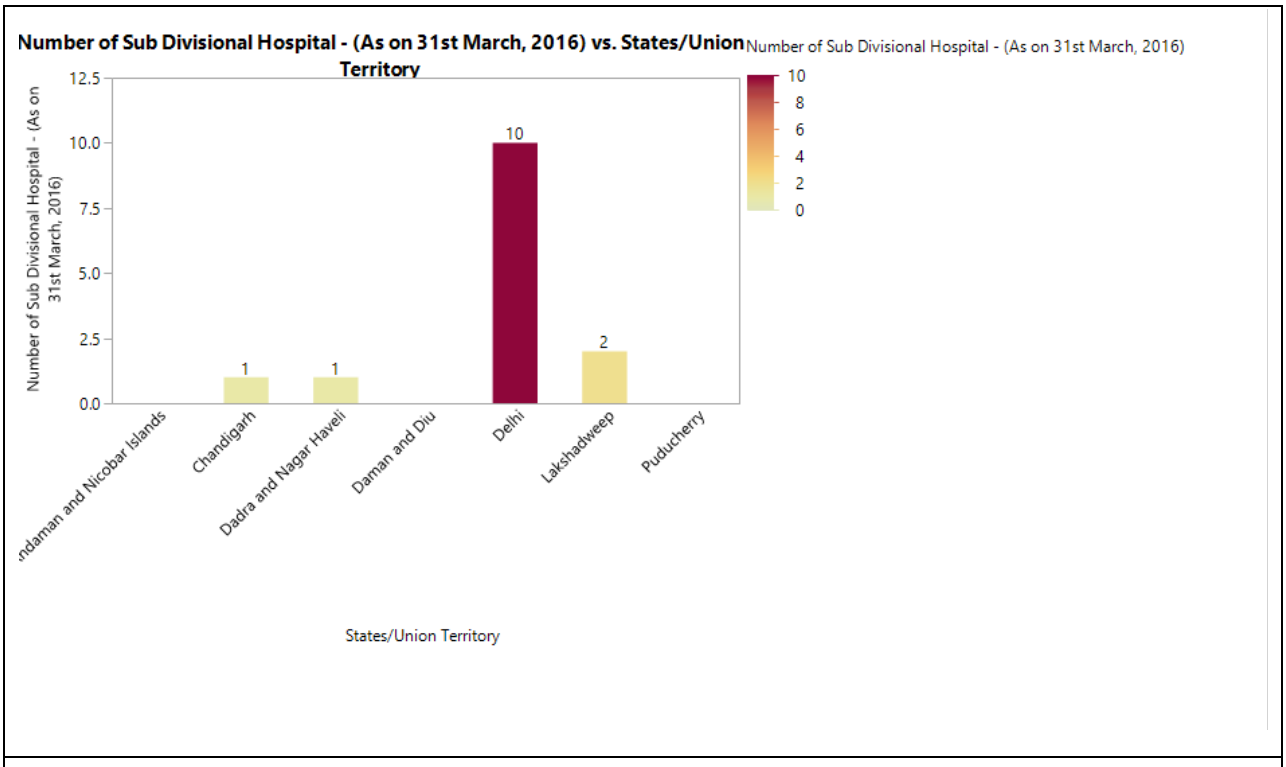


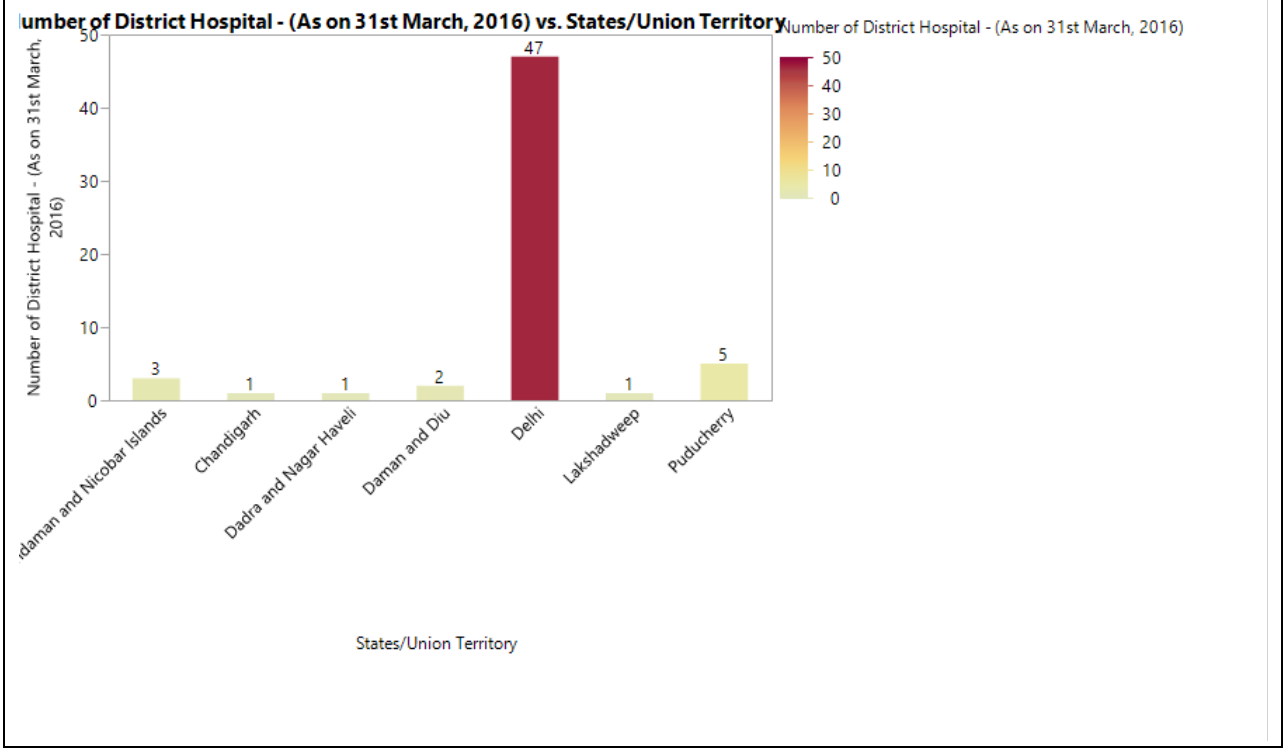
★ Visualizing the Number of **Health Centers** with respect to each **Union Territory**:



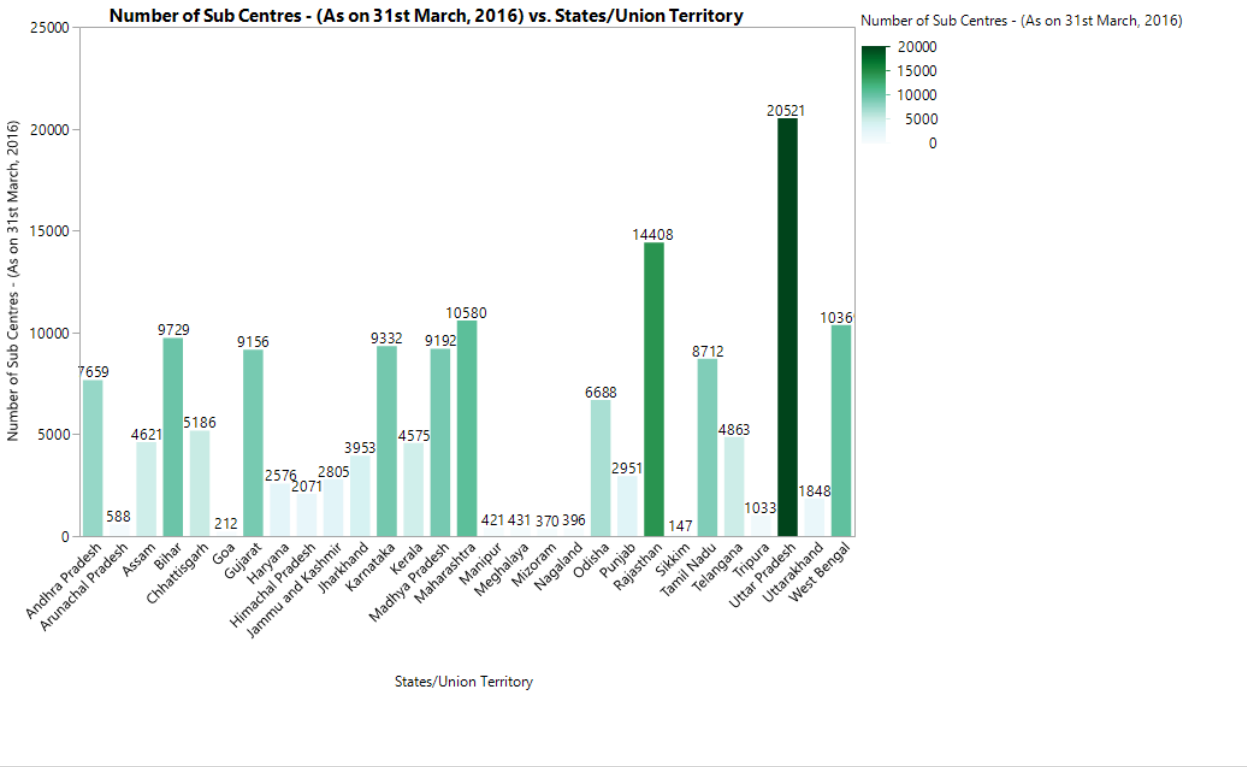

Number of PHCs - (As on 31st March, 2016) vs. States/Union Territory
Number of PHCs - (As on 31st March, 2016)
25.0
20.5
16.0
11.5
7.0
2.5
Number of PHCs - (As on 31st March, 2016)
30
25
20
15
10
5
0
22
3
11
4
5
4
24
an and Nicobar Islands
Chandigarh
Dadra and Nagar Haveli
Daman and Diu
Delhi
Lakshadweep
Puducherry
States/Union Territory

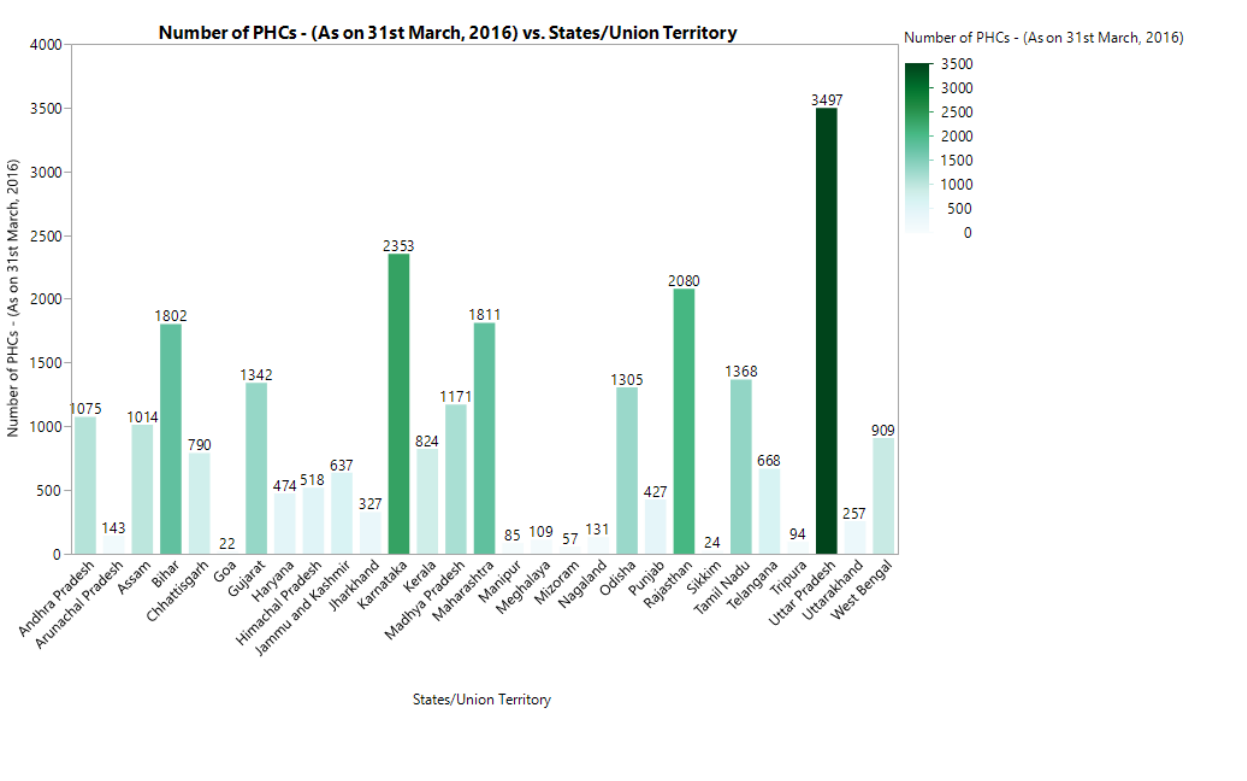

Number of CHCs - (As on 31st March, 2016) vs. States/Union Territory
Number of CHCs - (As on 31st March, 2016)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Number of CHCs - (As on 31st March, 2016)
5
4
3
2
1
0
4
2
2
3
3
an and Nicobar Islands
Chandigarh
Dadra and Nagar Haveli
Daman and Diu
Delhi
Lakshadweep
Puducherry
States/Union Territory

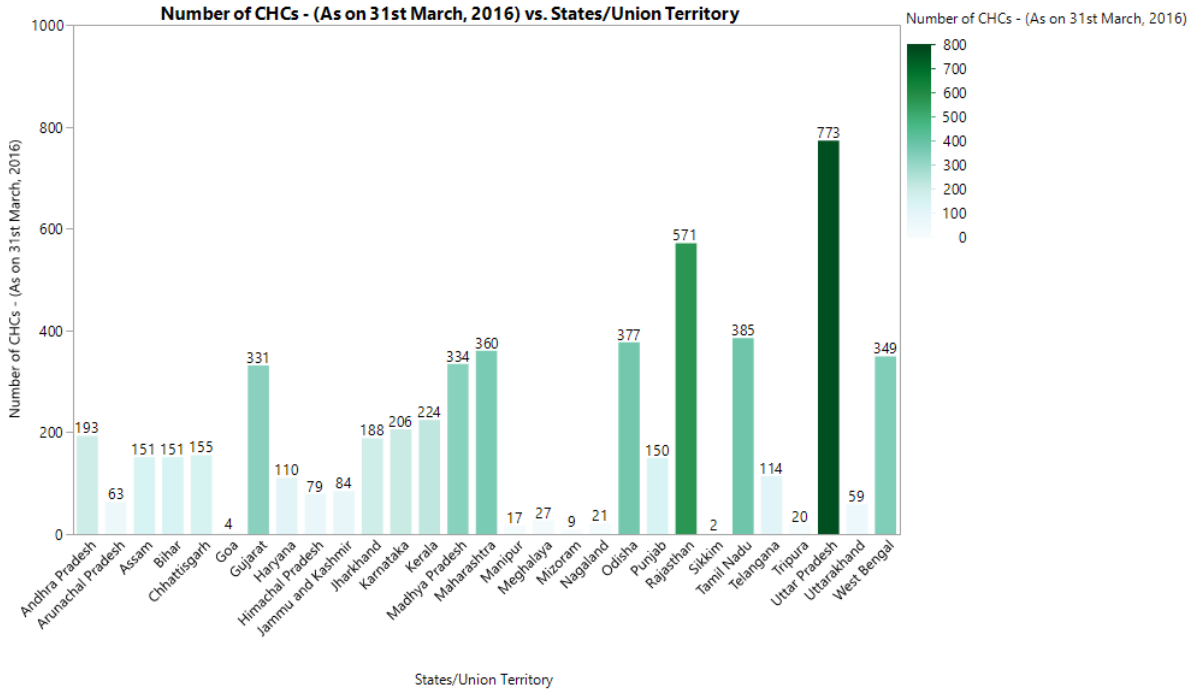

Number of Sub Divisional Hospital - (As on 31st March, 2016) vs. States/Union Territory
Number of Sub Divisional Hospital - (As on 31st March, 2016)
Number of Sub Divisional Hospital - (As on 31st March, 2016)
12.5
10.0
7.5
5.0
2.5
0.0
10
8
6
4
2
0
1
1
10
2
ndaman and Nicobar Islands
Chandigarh
Dadra and Nagar Haveli
Daman and Diu
Delhi
Lakshadweep
Puducherry
States/Union Territory

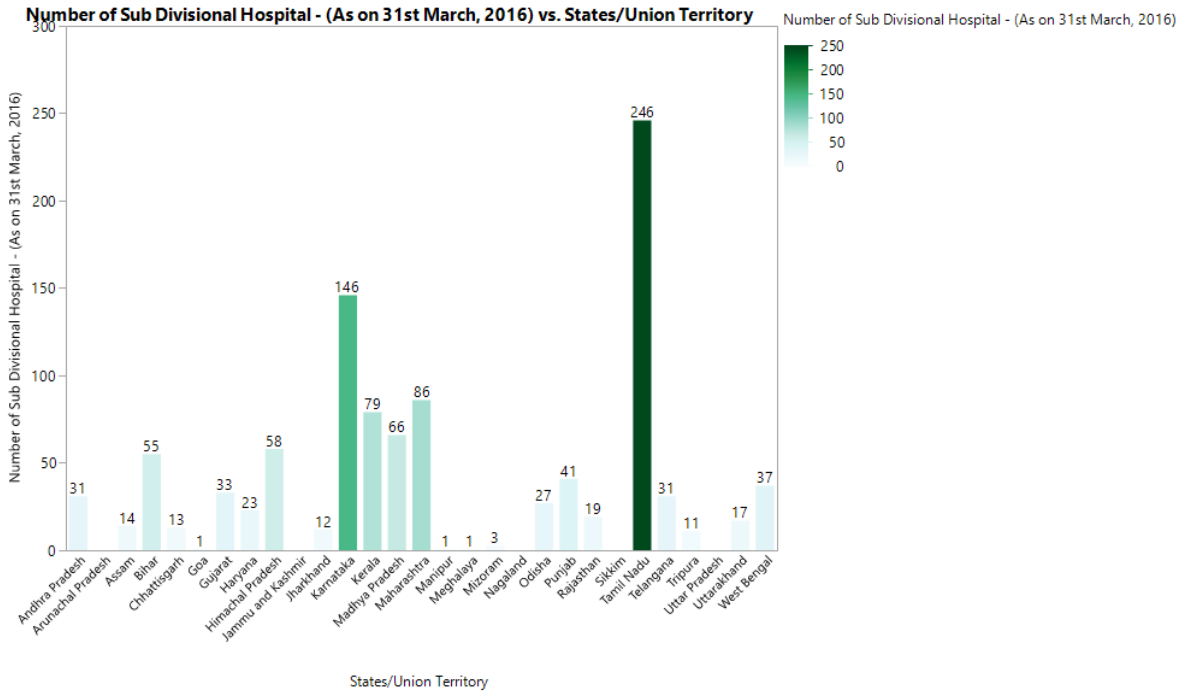

umber of District Hospital - (As on 31st March, 2016) vs. States/Union Territory
Number of District Hospital - (As on 31st March, 2016)
Number of District Hospital - (As on 31st March, 2016)
50
40
30
20
10
0
50
40
30
20
10
0
3
1
1
2
47
1
5
ndaman and Nicobar Islands
Chandigarh
Dadra and Nagar Haveli
Daman and Diu
Delhi
Lakshadweep
Puducherry
States/Union Territory

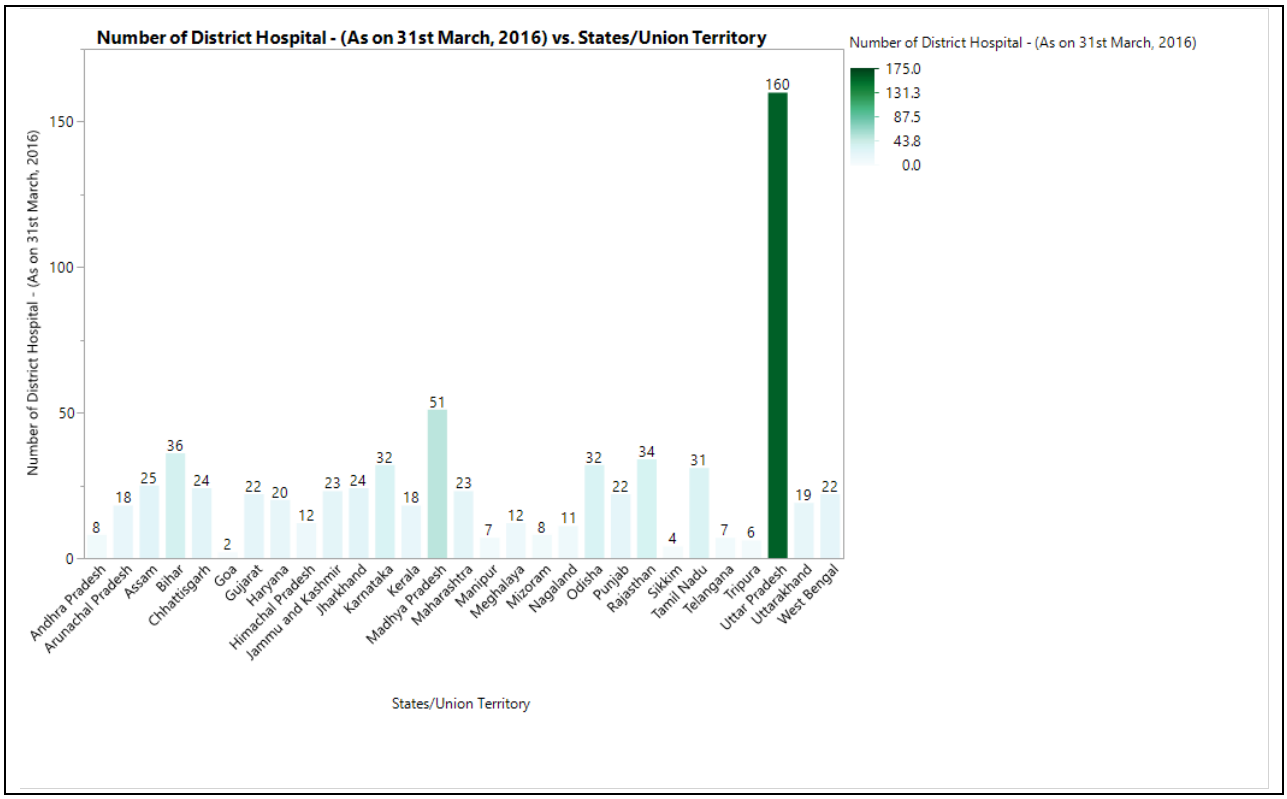
★ Visualizing the Number of **Health Centers** with respect to each **State**:



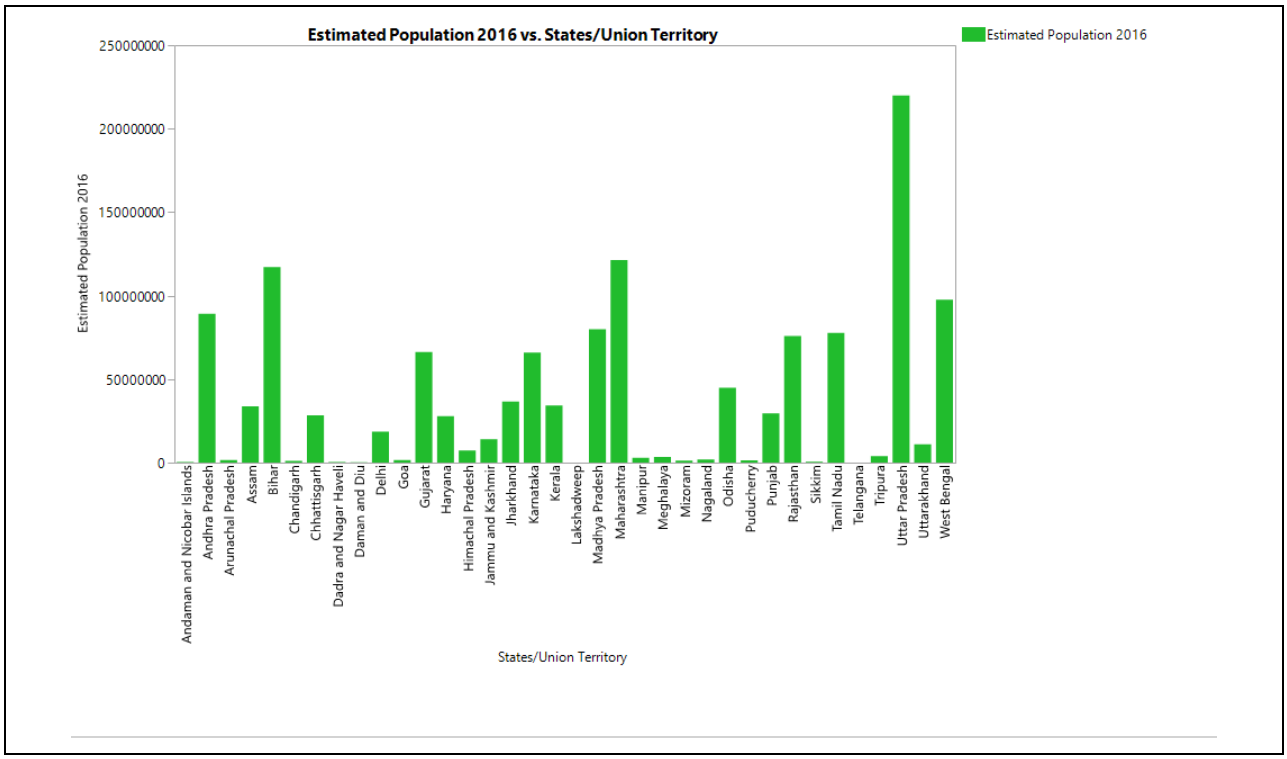



Number of CHCs - (As on 31st March, 2016) vs. States/Union Territory
Number of CHCs - (As on 31st March, 2016)
800
700
600
500
400
300
200
100
0
1000
800
600
400
200
0
Number of CHCs - (As on 31st March, 2016)
193
63
151
151
155
4
331
110
79
84
188
206
224
334
360
17
27
9
21
377
150
571
2
385
114
20
773
59
349
Andhra Pradesh
Arunachal Pradesh
Assam
Bihar
Chhattisgarh
Goa
Gujarat
Haryana
Himachal Pradesh
Jammu and Kashmir
Jharkhand
Karnataka
Kerala
Madhya Pradesh
Maharashtra
Manipur
Meghalaya
Mizoram
Nagaland
Odisha
Punjab
Rajasthan
Sikkim
Tamil Nadu
Telangana
Tripura
Uttar Pradesh
Uttarakhand
West Bengal
States/Union Territory

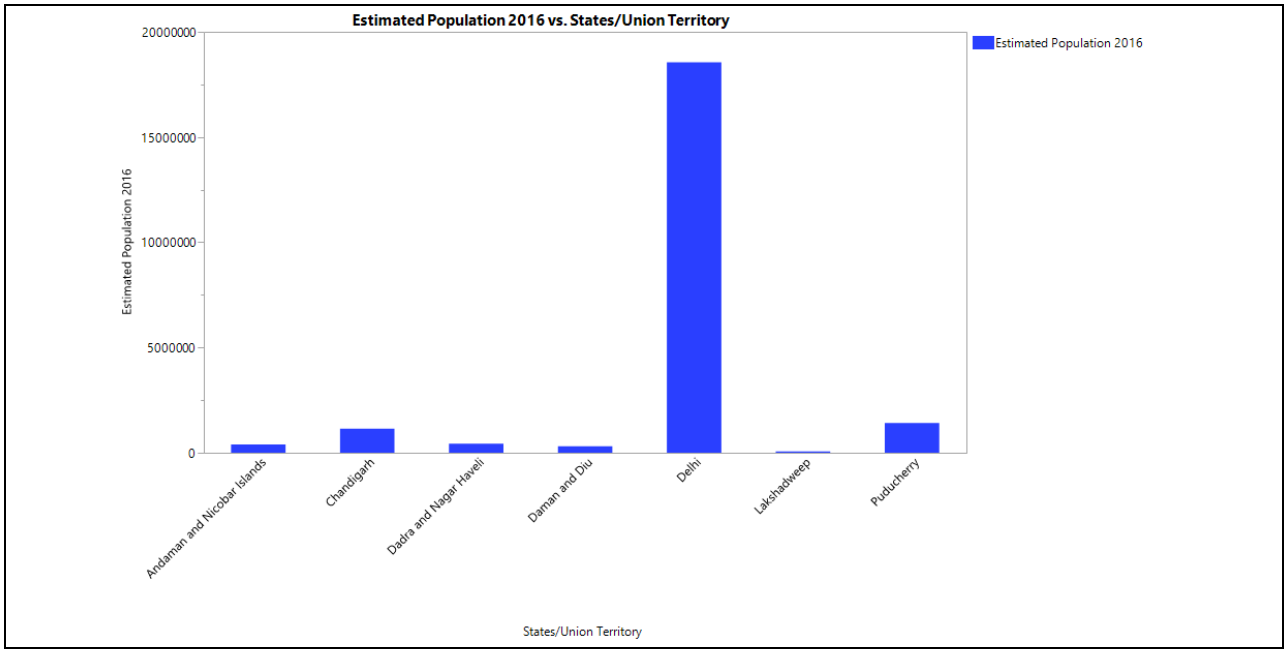

Number of Sub Divisional Hospital - (As on 31st March, 2016) vs. States/Union Territory
Number of Sub Divisional Hospital - (As on 31st March, 2016)
250
200
150
100
50
0
300
250
200
150
100
50
0
Number of Sub Divisional Hospital - (As on 31st March, 2016)
31
14
55
13
1
33
23
58
12
146
79
66
86
1
1
3
27
41
19
246
31
11
17
37
Andhra Pradesh
Arunachal Pradesh
Assam
Bihar
Chhattisgarh
Goa
Gujarat
Haryana
Himachal Pradesh
Jammu and Kashmir
Jharkhand
Karnataka
Kerala
Madhya Pradesh
Maharashtra
Manipur
Meghalaya
Mizoram
Nagaland
Odisha
Punjab
Rajasthan
Sikkim
Tamil Nadu
Telangana
Tripura
Uttar Pradesh
Uttarakhand
West Bengal
States/Union Territory



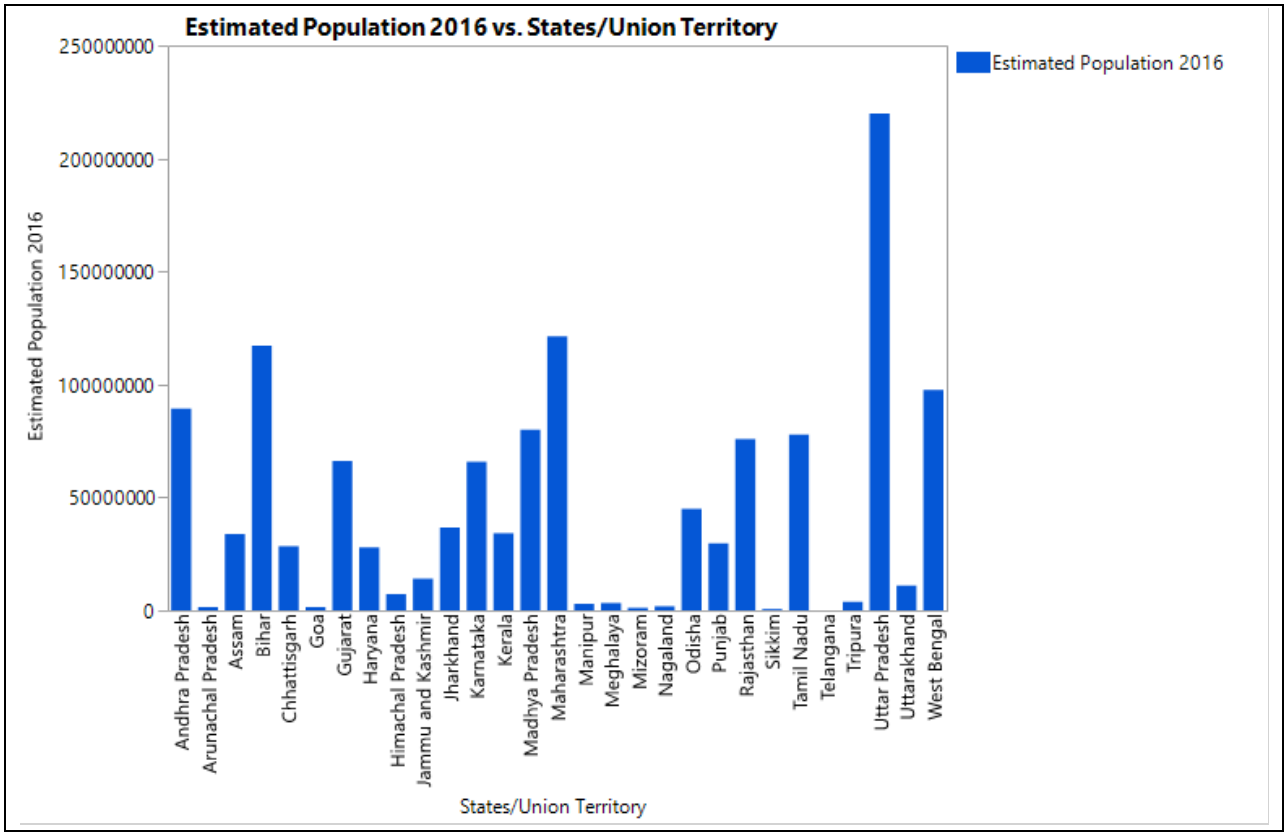
★ Visualizing the **Population** with respect to every place:



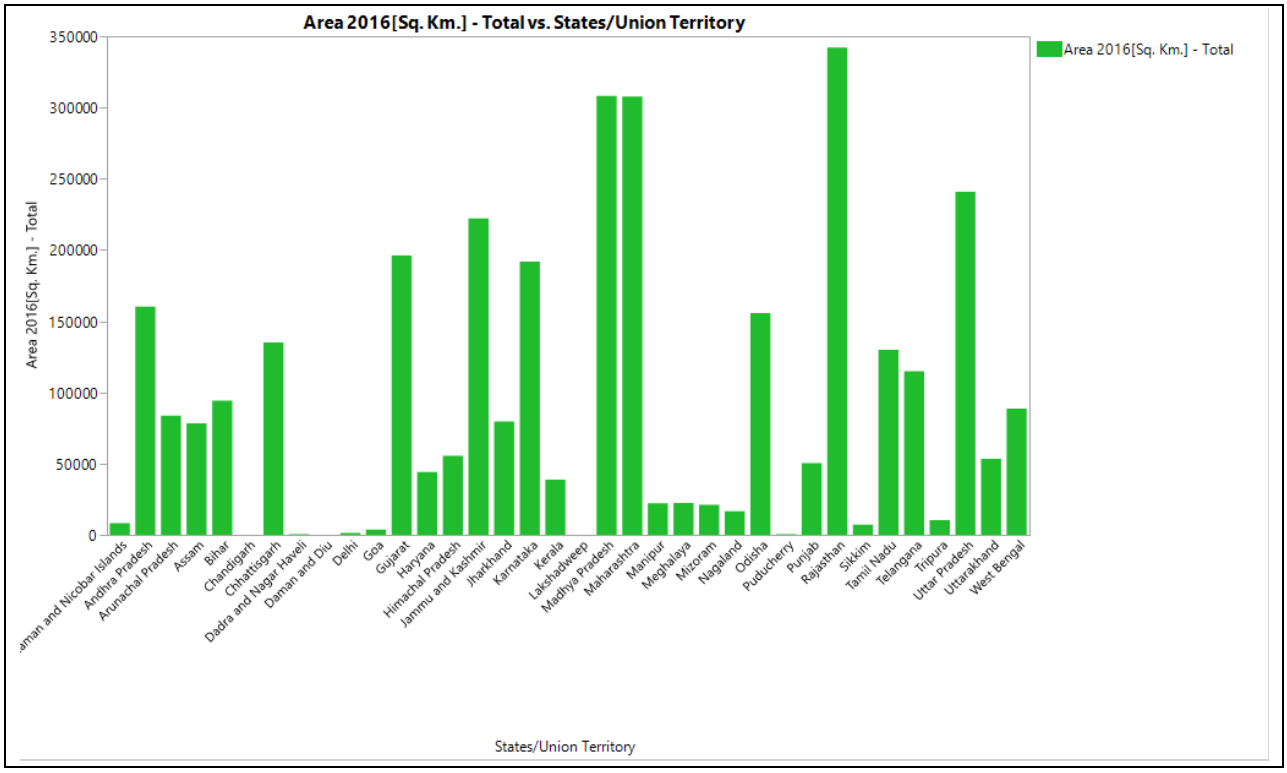
★ Visualizing the **Population** with respect to each **Union Territory**:



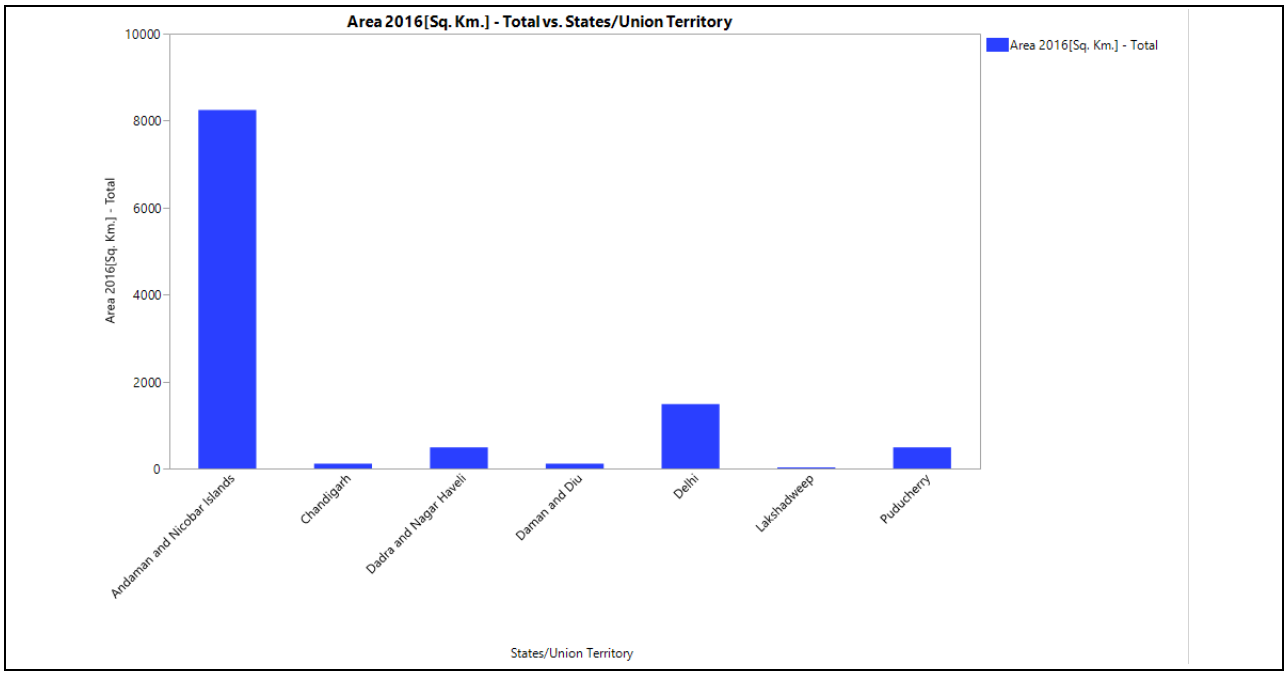
★ Visualizing the **Population** with respect to each **State**:



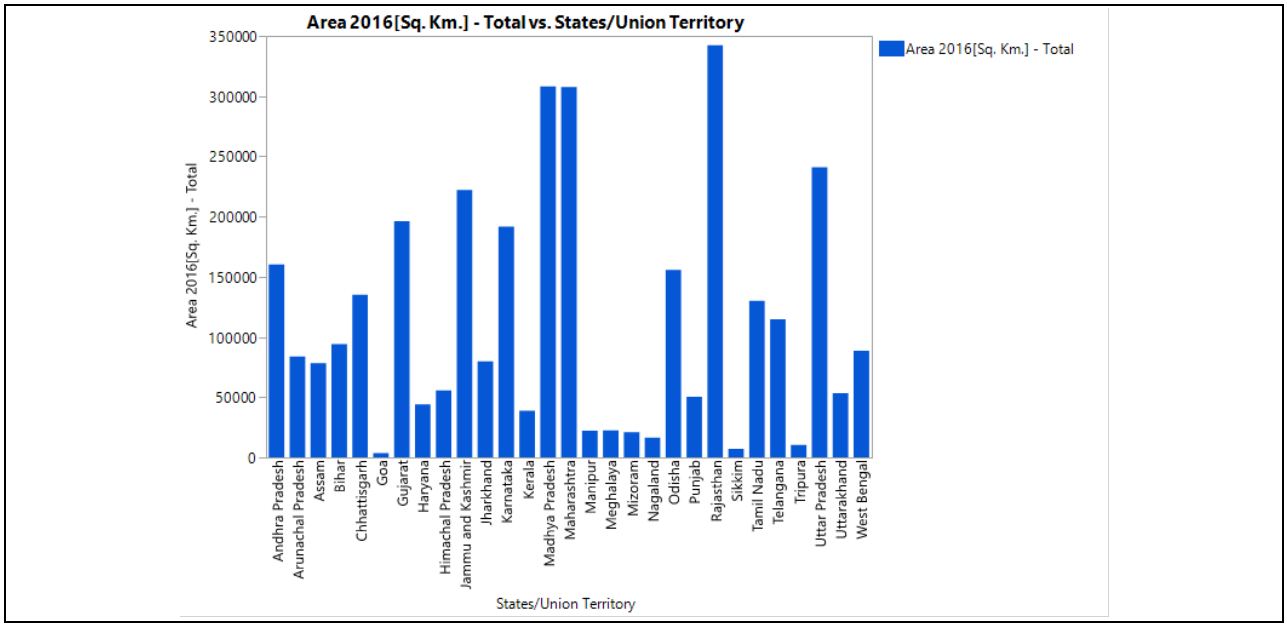
★ Visualizing the **Area** with respect to every place:



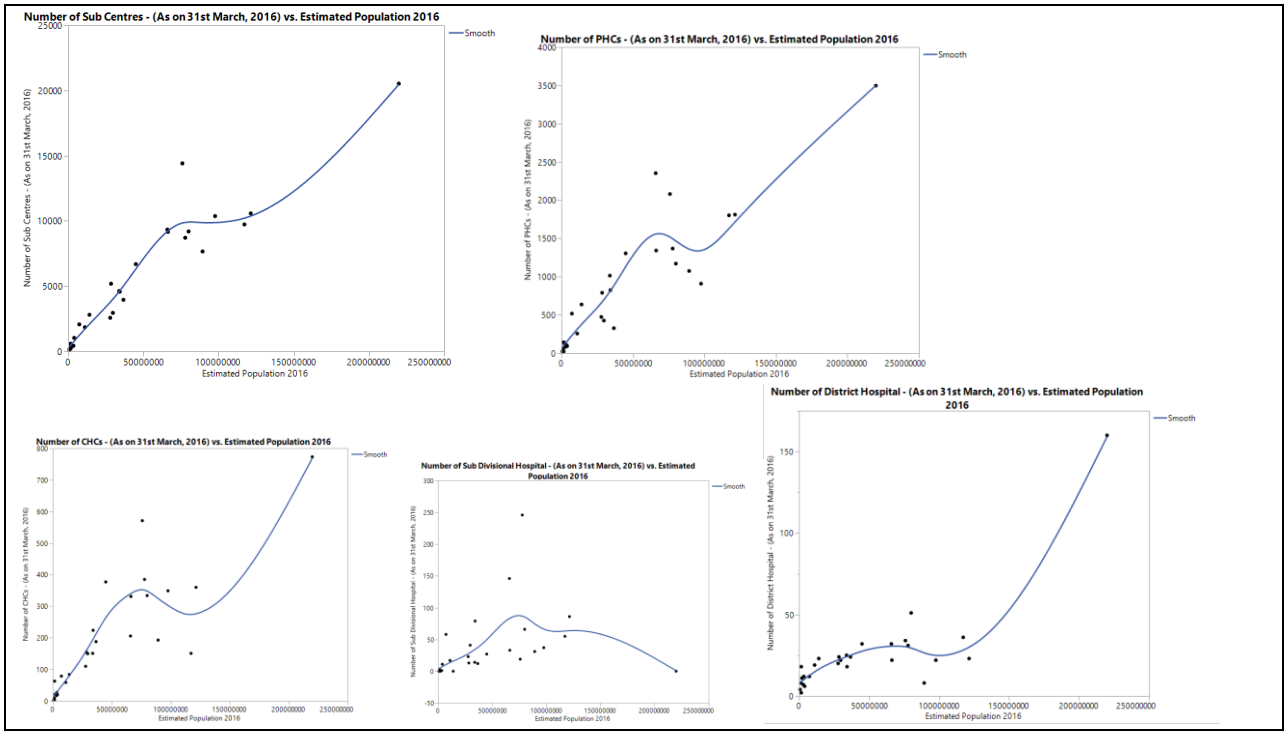
★ Visualizing the **Area** with respect to each **Union Territory**:



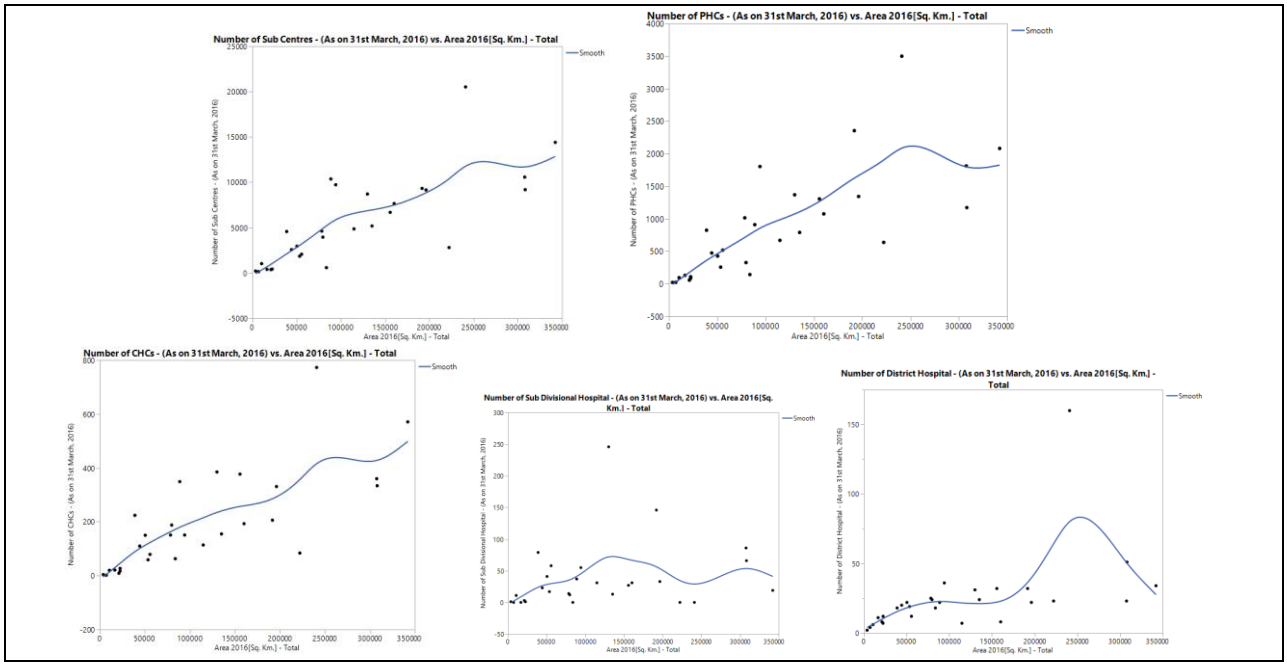
★ Visualizing the **Area** with respect to each **State**:



★ Checking the relation between **Health Centers** and **Population**



★ Checking the relation between **Health Centers** and **Area**



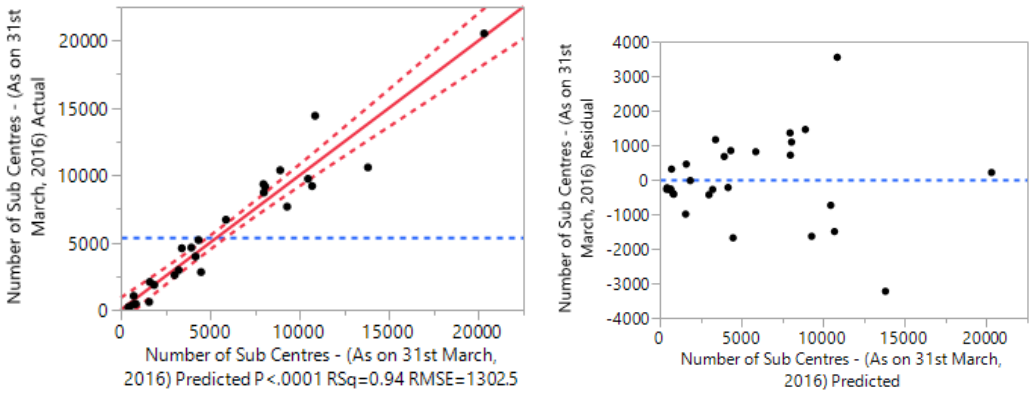
Results

- ★ **Delhi** being the capital of India, even though has less area is highly populated and has high number of health centers available in all of the Union Territories.
- ★ **Uttar Pradesh** being the most populated State, (even though fourth in area) has high number of health centers available in all of the States.
- ★ We can see a slight positive correlation between the health centers available and the population as well as the health centers available and the area of the states. (Except for the Sub Divisional Hospitals and the District Hospitals)
- ★ When the **Multiple Linear Regression Model** is fit between the Health Centers available as Predictor and the Estimated 2016 Population and Area as the Responses the following results were obtained:

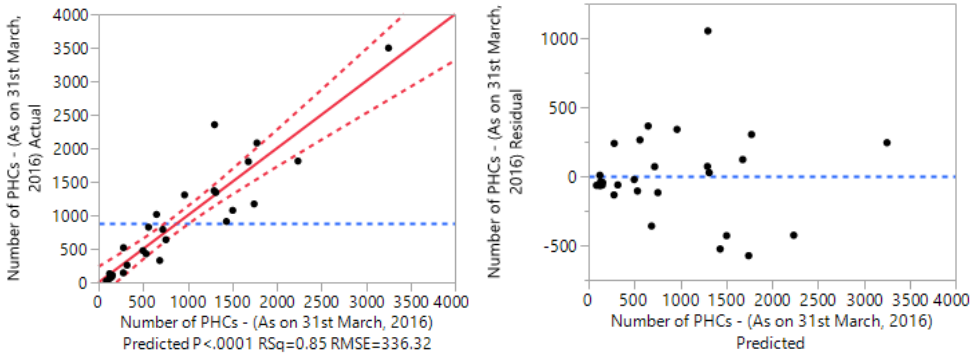
    - There is a significant relationship – For Sub Centers, PHCs and CHCs
    - There is a significant relationship only with the estimated population parameter – For District Hospitals
    - There is no significant relationship – For Sub Divisional Hospitals

★ The plots for the model are as follows:

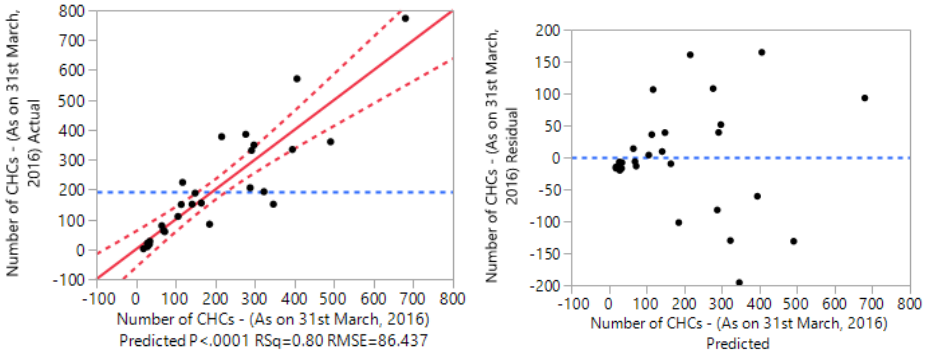
For **Sub Centers:**



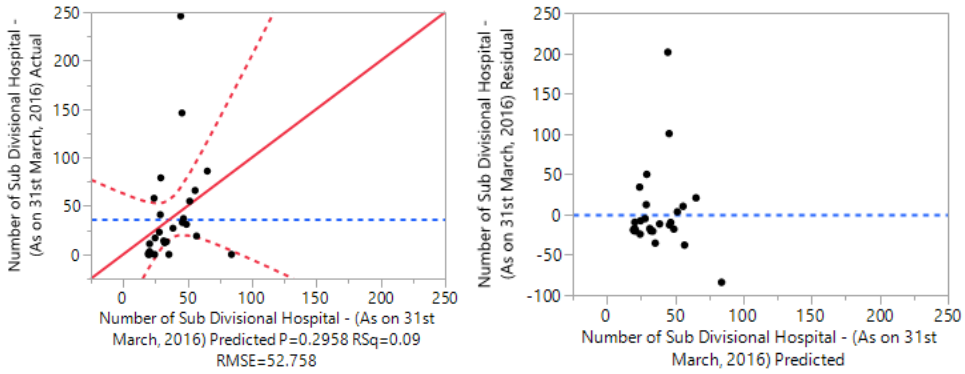
For **PHCs**



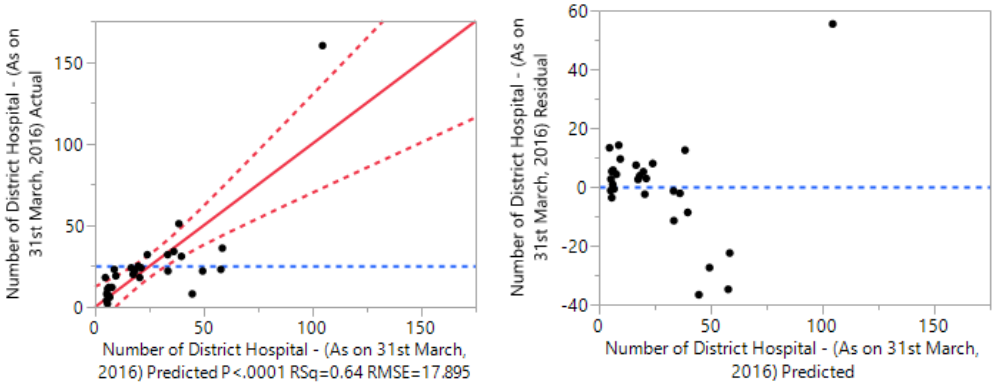
For **CHCs**



For **Sub Divisional Hospitals**



For **District Hospitals**



- ★ The plots show that probably the high population and high area are some of the important reasons for the high availability of Sub Centers, PHCs and CHCs in a particular State or Union Territory.
- ★ Population is the major reason for the availability of District Hospitals
- ★ Availability of Sub Divisional Hospitals might have more factors affecting
- ★ These results have been obtained from the p-values as well as the R square values for the models.
- ★ These parameters are well explaining the Sub Centers model as the R square is 0.93 i.e, 93% variability was explained. So, this is a very good model.

Future Research

More data on parameters like literacy rates, sex ratio, government rules, ruling parties etc., can be collected and the reasons for the particular number of health centers can be analyzed in future to fit the best model.