IITB-ISRO-AICTE MAPATHON

Documentation Of The Project

Topic – Health infra, population, age group etc. for Vaccination.

Team – Bhuchitra

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BHUCHITRA

TOPIC: Health infra, population, age group etc. for Vaccination.

METHODOLOGY

INTRODUCTION

The Covid-19 pandemic allows us to study the issue in more detail and reliably. The issue is also important in the connection to monitoring appropriate immunisations and vaccinations.

To have a proper reflection of health infrastructure and health status of the state, the study has considered the basic district level indicators – Population, Population density, Population per bed (both govt and private),Number of subdistricts COVID-19 hospitals, Availability of Beds in those Medical Institutions,No of incidences per 1000 people,Recoveries per 1000 patient and No. of deaths per 1000 people.

The following sets of district level data are utilized to prepare the maps based on the selected topic:

- Population(figure 1)
- Population Density (figure 9)
- Number of subdistrict COVID-19 hospitals.
    - Government: (figure 2)
    - Private(figure 3)
- Population per bed:
    - Government (figure 4)
    - Private(figure 5)
- COVID-19 cases per 1000 people(figure 6)
- Recoveries per 1000 COVID-19 patients (figure 8)
- Deaths per 100 COVID-19 patients(figure 7)
- District wise COVID-19 situation rank (figure 10)

POPULATION:

Since coronavirus (SARS-COV-2) transmits via human contact (Chan et al. 2020; Li et al. 2020), the common perception is that Covid-19 spreads rapidly in densely populated areas.

In this context, identifying the size, structure and distribution of a population across the districts is essential for planning, monitoring and improving the healthcare systems in this situation.

Figure 1.

West Bengal Population
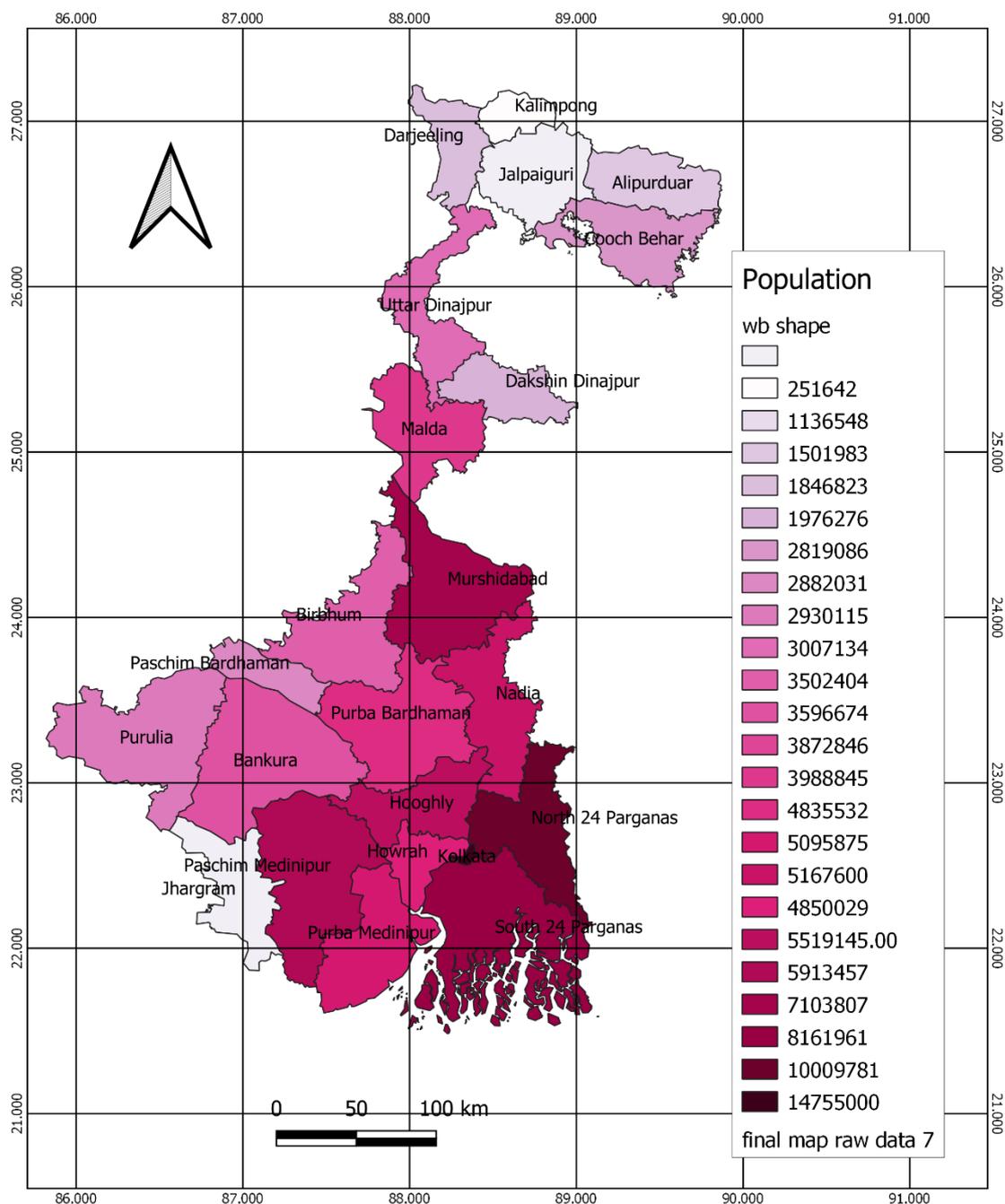
POPULATION DENSITY.

As stated earlier,dense areas lead to more face-to-face interaction among residents, which makes them potential hotspots for the rapid spread of pandemics. The data shows that higher density is correlated with higher infection and mortality rates Hence in order to illustrate the role of population density in the covid-19 spread, we have taken this data into account.

Figure 9

Population Density
(No of People Per sq. km.)

People Per sq. km.
- 234 - 535
- 535 - 836
- 836 - 1137
- 1137 - 1438
- 1438 - 1739
- 1739 - 2040
- 2040 - 2340
- 2340 - 2641
- 24006 - 24306
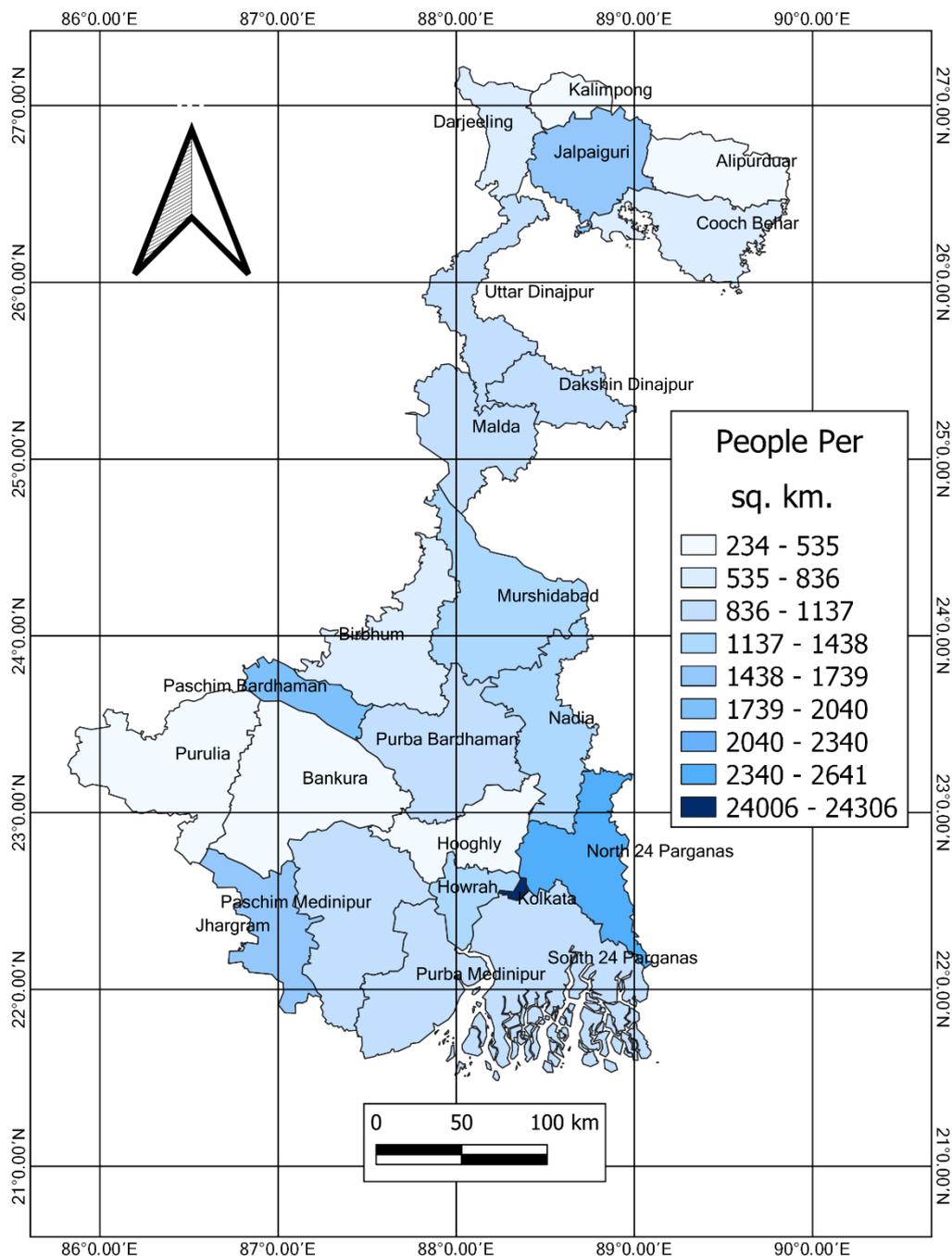
Number of subdistrict COVID-19 hospitals.

Health infrastructure is the elementary need to have a good health condition. The study seeks to analyse the Health Infrastructure and resulting in proper vaccination across all Districts of West Bengal in this pandemic situation. To have a proper reflection of health infrastructure in both urban and rural areas of the state, we have separately chalked out the data of government and private hospitals.

Economically richer districts are found to be having a greater number of private hospitals as there is a strong association between wealth of the people and preference to private health care. However, these hospitals are beyond the reach of the poor people because of highly expensive system of health care. Hence district hospitals as well as the medical college hospitals are found to be overcrowded with patient pressure indicating poor service from the primary or rural health institutions.

Given this scenario, it is imperative that the status of the sector is explored in detail and it is expected that the study will be able to elucidate the current status of health sector in the state and shed light on the drawbacks and necessary measures.

# Figure 2. Number of Govt. covid Hospitals
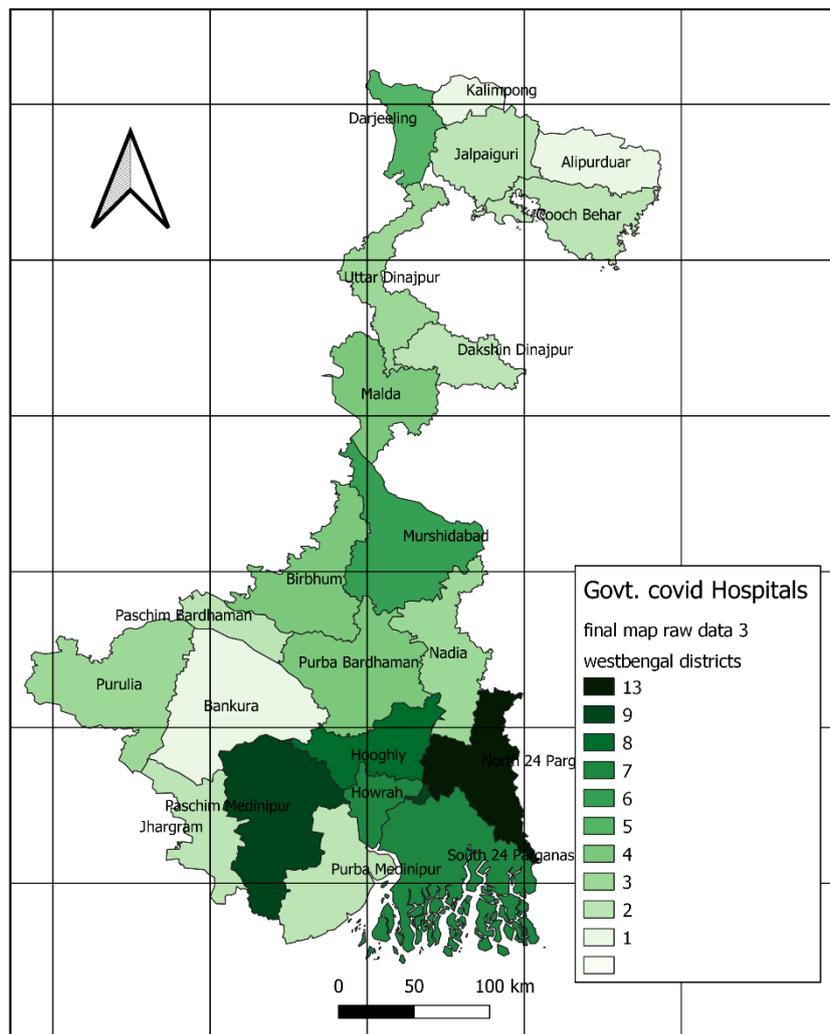
West Bengal Private Covid Hospitals

Private Hospitals

wb shape

	0
	1
	6
	59

final map raw data 9
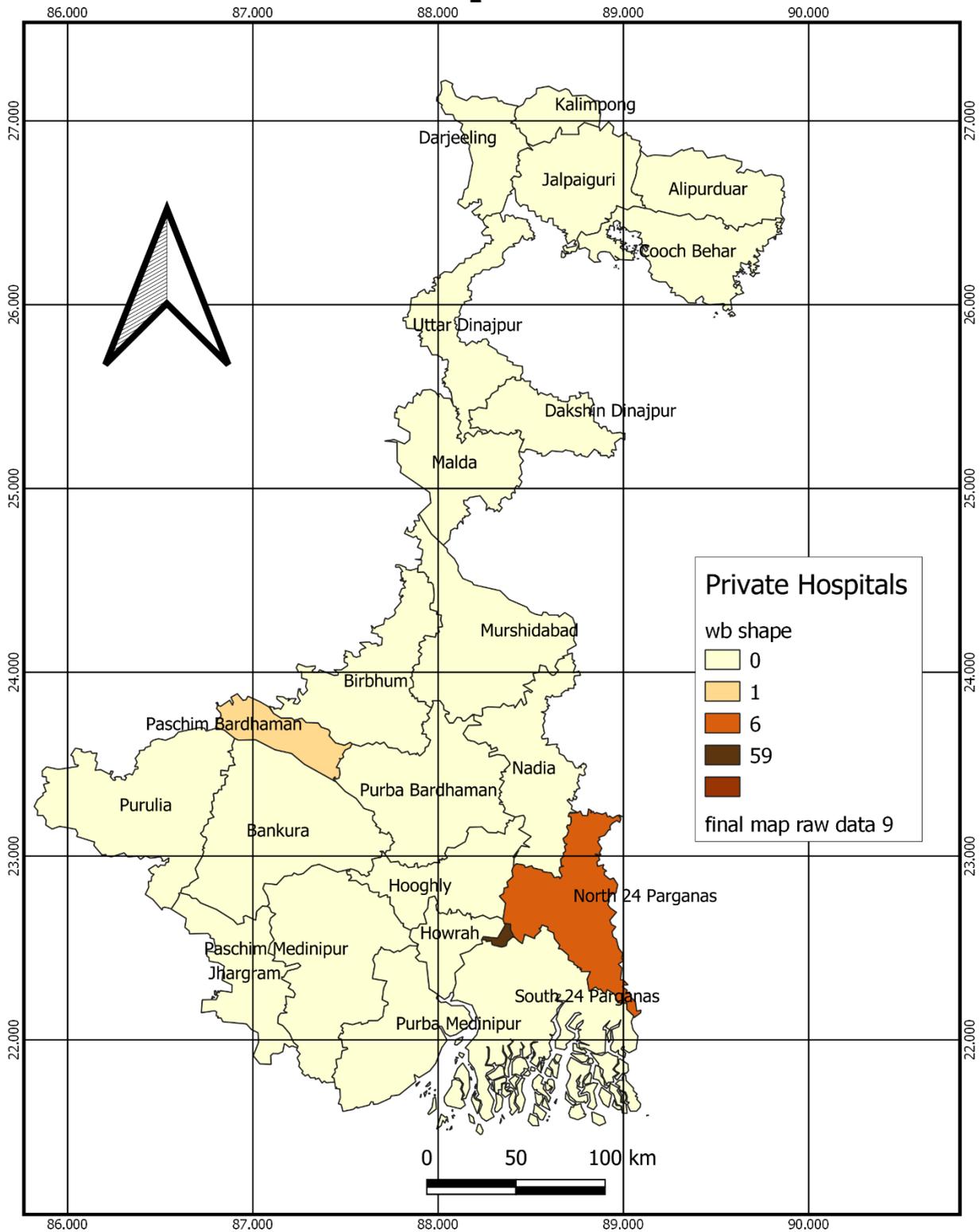
Population per bed (both govt and private):

A higher population per health care institution implies lower resilience of an area. Hence to have a better understanding of the three -tier health infrastructure of west Bengal this data has been also taken into consideration.

Figure 4

Population per bed in Govt. covid Hospital
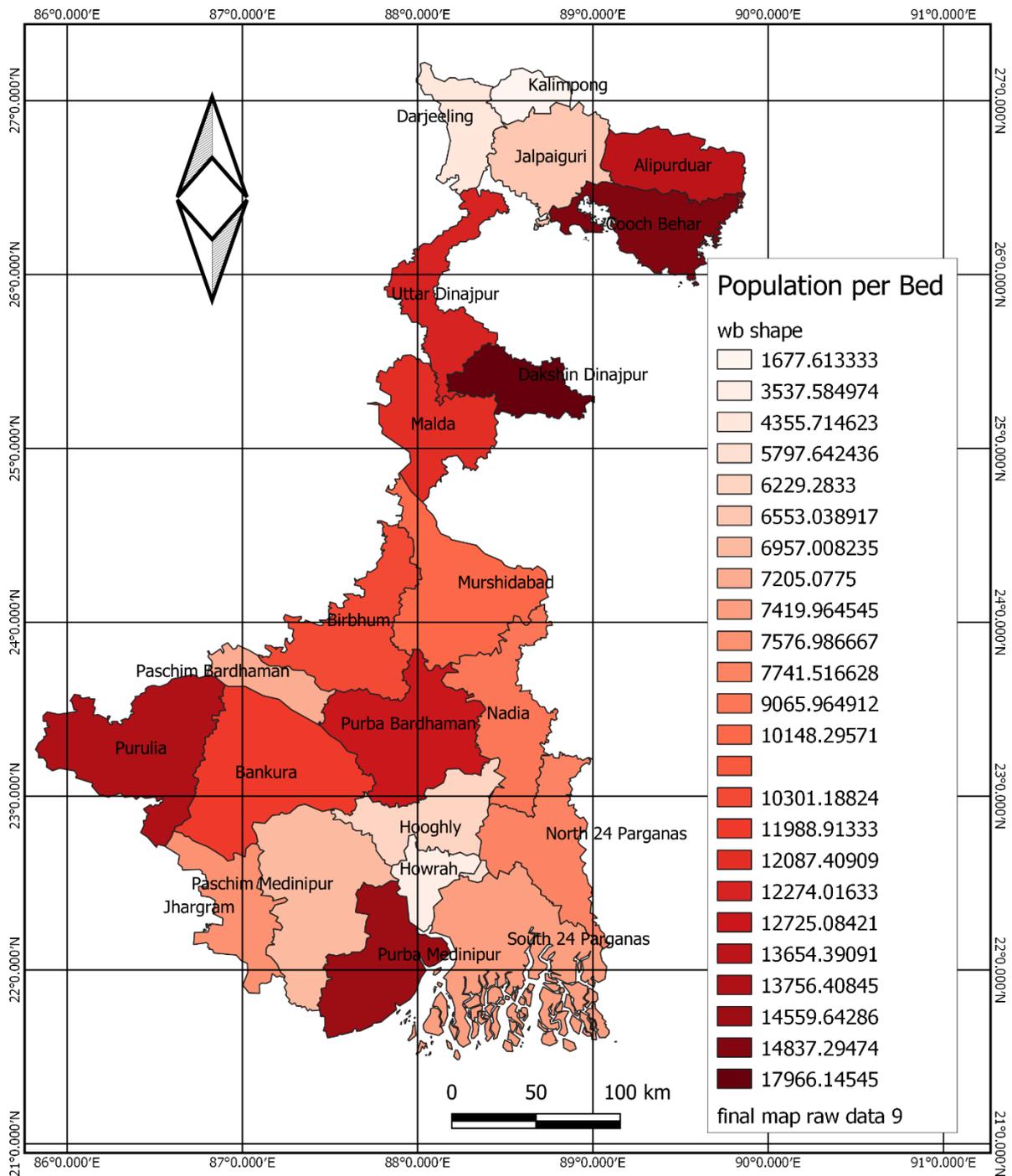
Figure 5

Population per bed in pvt. covid hospitals
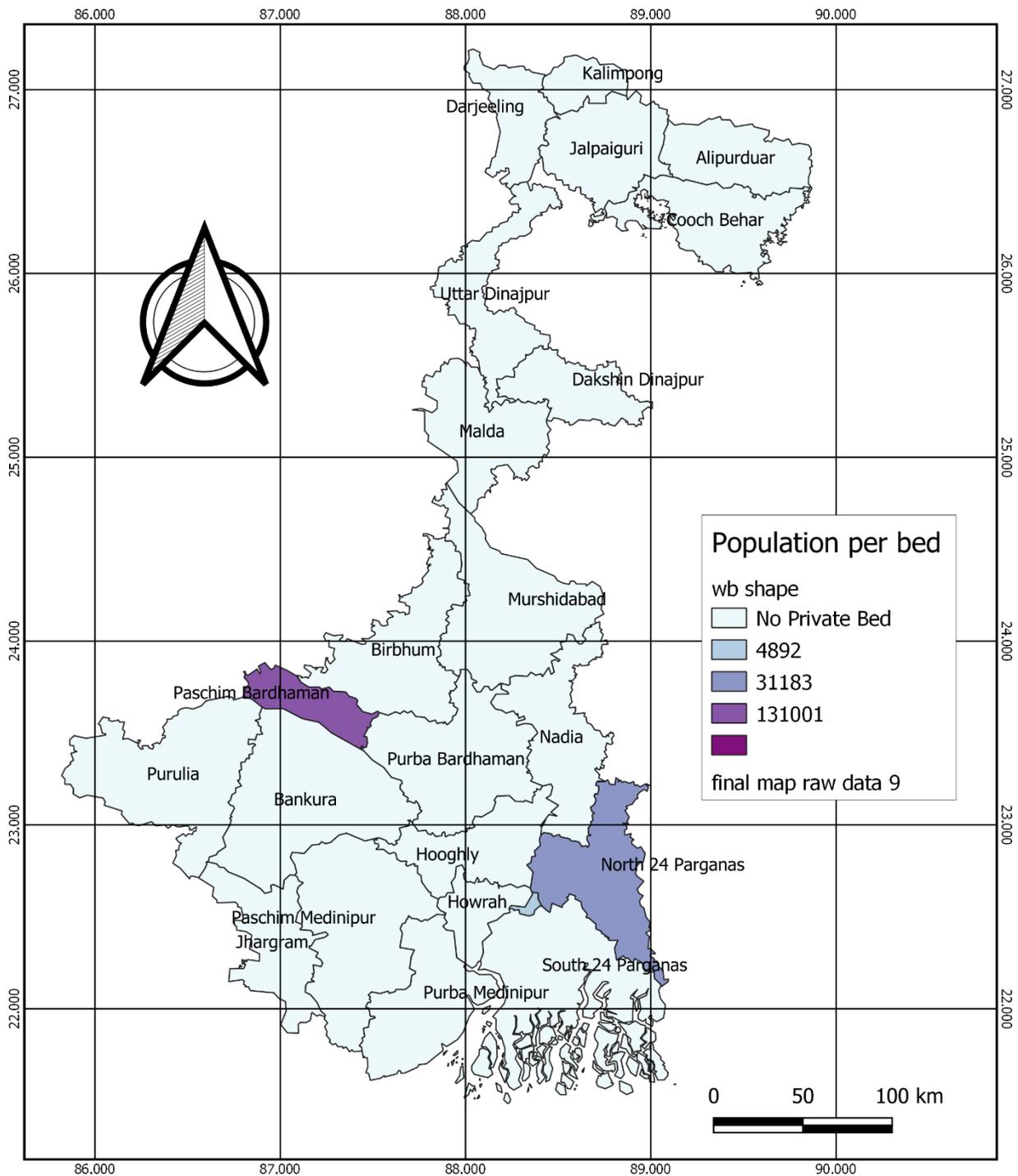
COVID-19 Cases per 1000 people

The COVID-19's potential outreach in a particular district has been assessed by the number of COVID-19 cases per 1000 people for that district. As such, the higher the number of COVID19 cases in a district, the higher would be its outreach potentiality towards the surrounding districts.

Figure 6

No of Covid Cases Per 1000 People

Cases Per 1000 People

- 11.54201076
- 9.550455025
- 8.508118677
- 8.284445951
- 7.081813325
- 5.300775738
- 5.119090004
- 5.071295747
- 4.387548532
- 4.147960368
- 4.12403169
- 4.077871714
- 3.917678514
- 3.681272119
- 3.337810692
- 3.136786931
- 3.11493678
- 2.71356474
- 2.588540035
- 2.514097725
- 2.34530044
- 2.125279419
- 1.671075805
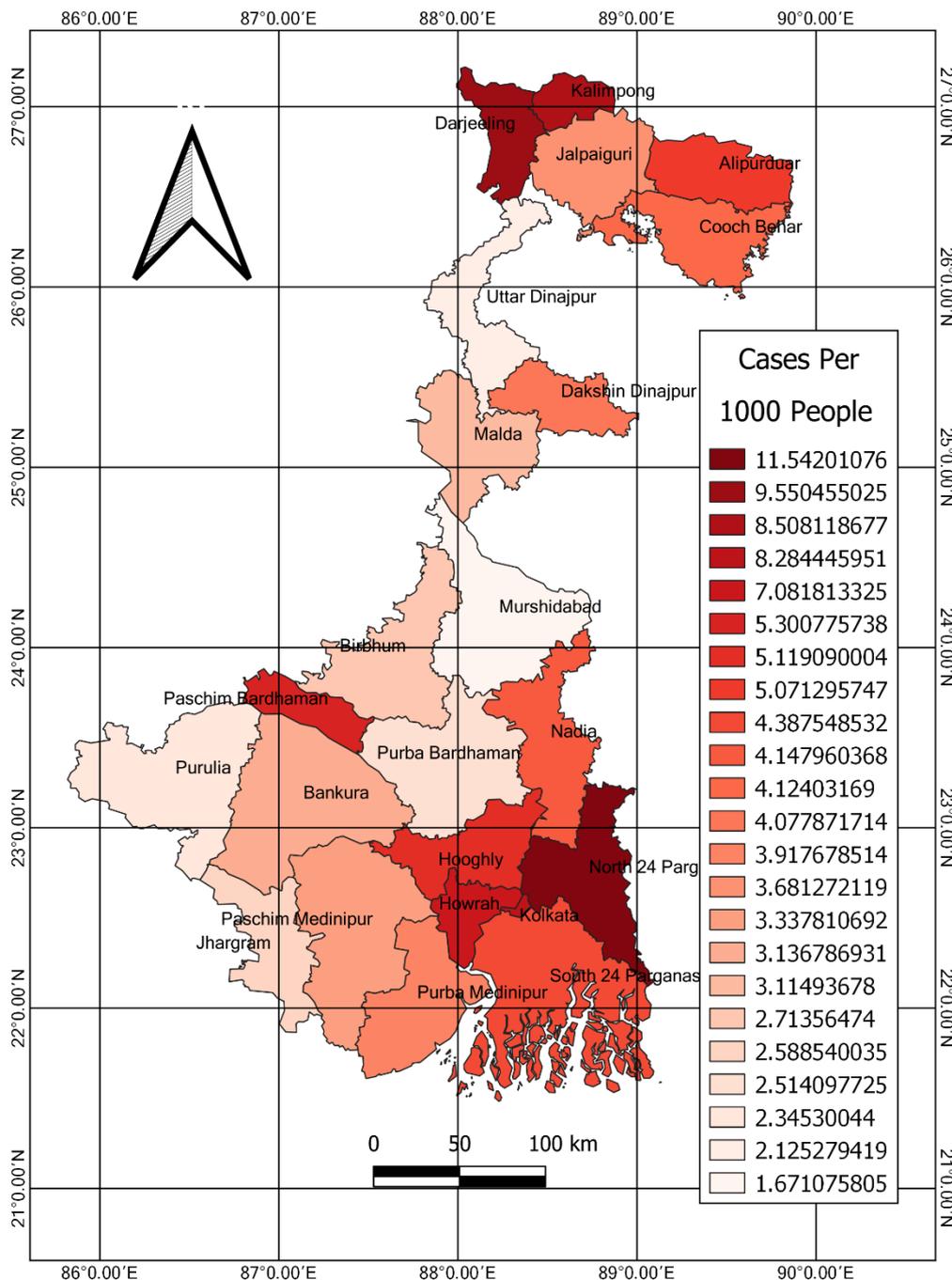
Recoveries per 1000 Covid-19 patients

The high rate of recoveries is more a pointer to better healthcare facilities rather than better or higher testing. Thus, to measure severity levels of a COVID-19 pandemic as well as the quality of the health infrastructure of the state, the data of Recovery rate per 1000 COVID 19 patients has been taken into consideration.

Figure 8

No of Recoveries Per 1000 Cases (Immunity Rate)
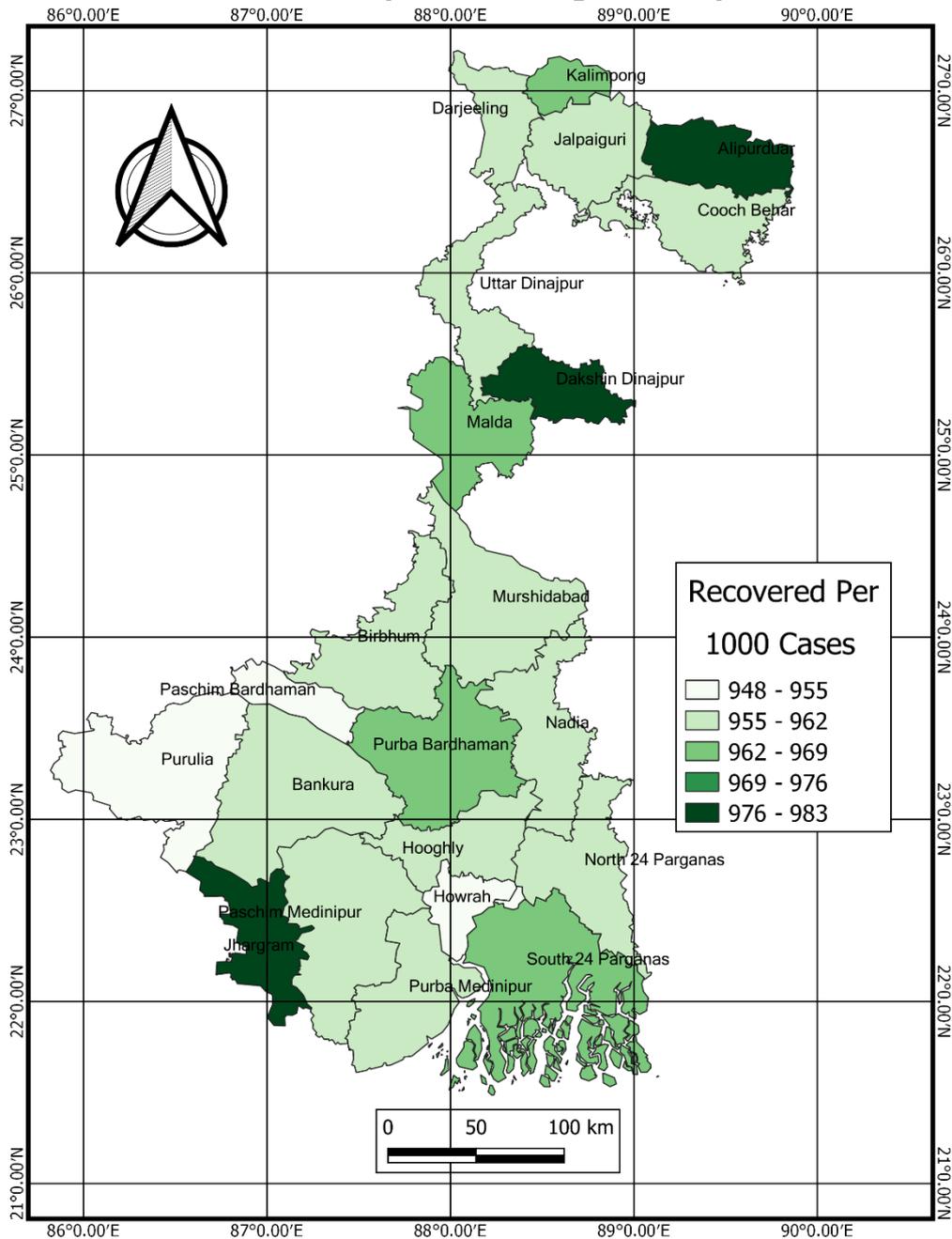
Deaths per 1000 Covid-19 patients

One of the most important ways to measure the severity of COVID-19 and characteristics of the healthcare system in a district is to measure the number of deaths occurred per 1000 Covid-19 patients in that particular district. It identifies the gaps in the health infrastructure of the state which is needed to be taken care of to tap the full socioeconomic potential of the region.

Figure 7
No of Deaths Per 1000 Cases (Mortality Rate)

Deaths Per 1000 Cases

	6.1 - 9.3
	9.3 - 11.5
	11.5 - 13.6
	13.6 - 15.8
	15.8 - 18.0
	18.0 - 20.2
	20.2 - 22.4
	22.4 - 24.5
	24.5 - 26.7
	26.7 - 28.9
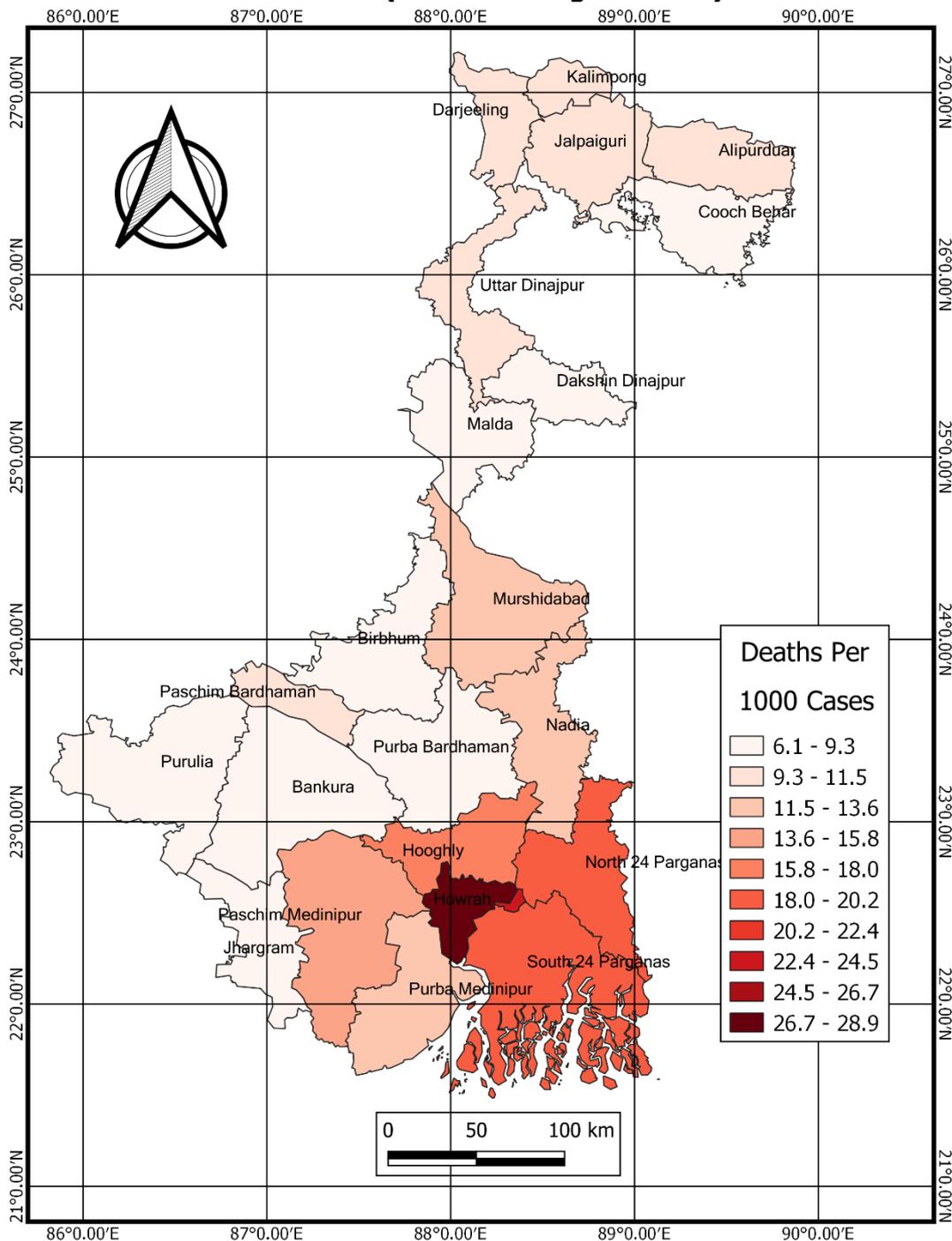
District wise COVID-19 situation rank

We ranked all districts related to their performance in COVID-19 situation. We took above three parameters Spreading rate, recovery rate and mortality rate. We ranked these three parameters and then we took the average of their respective ranks and then we ranked the calculated value again. Thus, we can visualise which district is better in overall COVID-19 situation

Figure:10

District wise covid situation rank
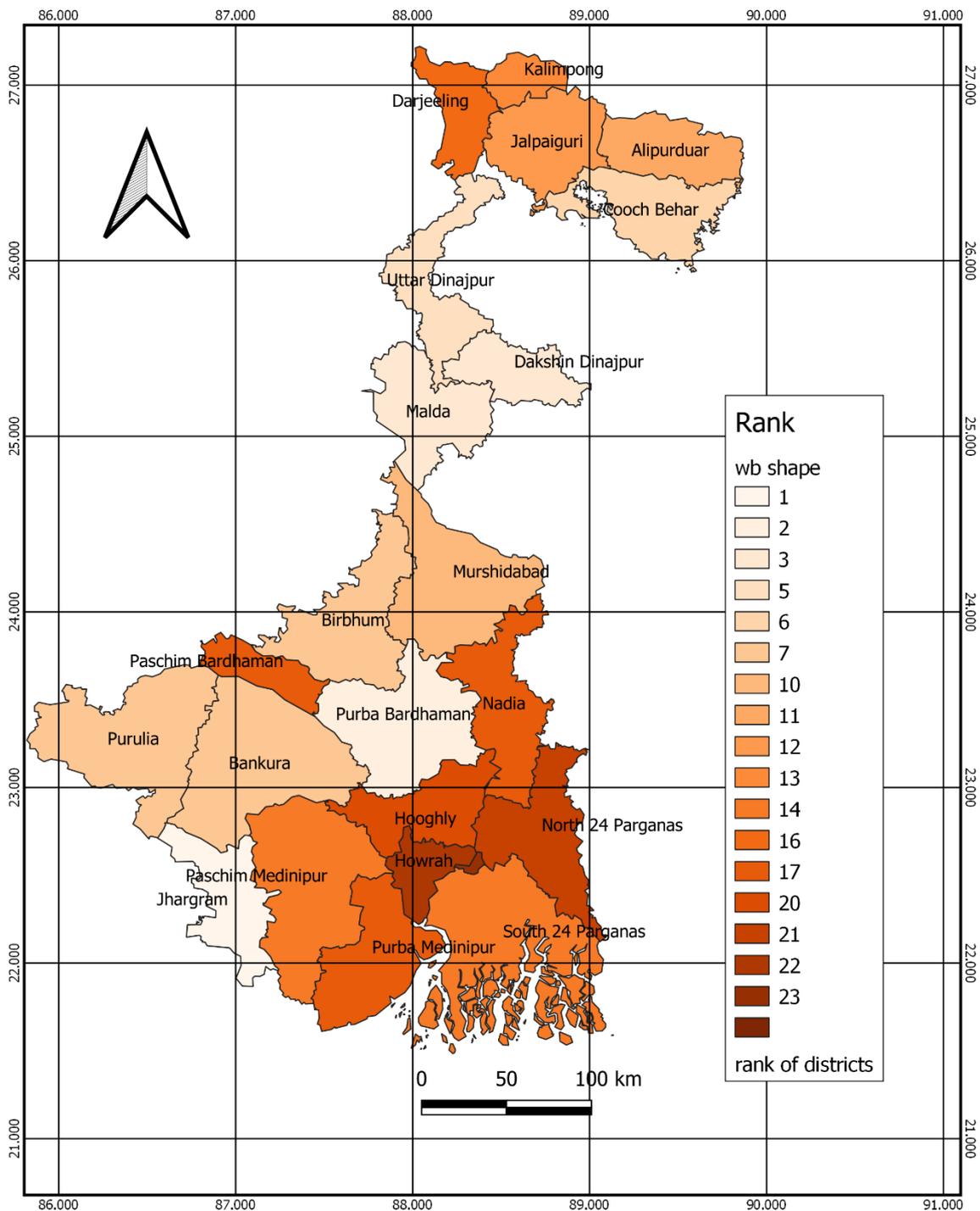
Complexities

- There were 19 districts in west Bengal as per the census 2011.But now there are 23 districts. So, a lot of problem was encountered while collecting appropriate and accurate data for all the present districts because of such disparities.

- In this mapathon, we have worked with the district level data of health infrastructure, health care conditions and COVID-19 spread. So such data relative to health is scarcely available at the website of Bhuvan and ISRO.

- We did not find so much data from ISRO websites related to our work.

- Covid-19 data variates too much every day. So, we tried to implement as latest data as we can.

- The last census was conducted in India in the year 2011. so, collecting reliable and updated data was cumbersome.

- A lot of discriminations were found in the data collected from different government websites

- We faced too much complexities to find the latest shape file of west Bengal.

SOURCES

The present district level study of West Bengal uses data mainly from the following websites:

1. We got hospital data from https://www.wbhealth.gov.in/pages/search_hospitals
2. We collected Covid-19 data from https://www.wbhealth.gov.in/pages/corona/bulletin.
3. We used https://www.census2011.co.in/census   for census data
4. We used https://www.covid19india.org/ to analysis Covid-19 situation.

The data related to Population, and Profile of Three Tier Health System has been taken from Census of India (2001 & 2011) and Department of Health & Family Welfare, Government of West Bengal.

Procedure

We divided our whole process into some categories.

- **Decision:**

  As our topic is about Health infra, population, age group etc. for Vaccination at first, we decided the topics on which we should work. We chose topics like population data, hospital capacity, spreading rate, mortality rate, recovery rate etc.

- **Data Collection:**

  This was one of the most important work. We spend lots of time for browsing and searching over reliable and useful data for our work. We searched on so many government websites to collect data. Then we verified the collected data from various websites to check whether there is any wrong information or not.

- **Learning:**

  Then we learned the open-source software QGIS from suggested websites and implemented our learning in small experiments.

- **GIS steps:**

  1. At first, the shape file of West Bengal is added as layer.
  2. Keeping the actual shape file unchanged, the features of the layer are exported as another shape file layer.
  3. The collected raw data sheet is added as a layer in csv(comma separated value) format.
  4. Then opening the properties of the exported shape file layer, a natural join (hence equi join) operation is performed on the table of exported shape file layer with the data sheet layer matching the common districts column of the both tables.
  5. The modified attribute table of the shape file layer is checked if there is any missing or extra or null value or not.
  6. The layer styling panel is opened to label and colour the map.
  7. The districts in the map are labelled with their names.
  8. The field/attribute of mapping is selected and the map is filled with a graduated colour ramp depending upon values/range.
  9. The precision and truncation are adjusted on the legend.
  10. Then a new layout is created for the map.
  11. The size and orientation of the layout are adjusted.
  12. The created map is added in the layout.
  13. The scale of the map is then adjusted.
  14. Frame, background is then added on the layout around the map.
  15. Grids, longitudes and latitudes are added on the map.
  16. Legend is then added.
  17. Scale bar, north line indicator are added on the map.
  18. Heading of the map, figure no, title of legend etc are written.
  19. The map layout is saved and exported as an image in JPG format.
  20. The all steps written above are executed again for the other maps.

APPLICATION

We hope that our maps will help during the time of giving COVID-19 vaccine. It will help to make decision in which places vaccine is needed urgently.

Using population data, we can predict how much vaccine is needed in a district. Using population density map government can choose the places with the most densities. Because in dense areas the COVID-19 spreading rate is higher. Like from our map we can predict that vaccine is needed more in Kolkata and north 24 parganas than districts like Purulia or Kalimgpong.

We projected availability of both government and private hospitals. So that government can decide in which place more hospitals should be situated. Because this hospital count will make a big impact on the rate of giving vaccines and curing COVID-19. We projected capacity of both government and private beds. Thus, we can see which place is more efficient to fight with COVID-19. We should implement more beds in poor bed capacity areas to increase the health infrastructure against covid-19.and also it will help to decide in which places we should give Covid vaccine first. For instance, we can see bed capacity is better in kalimpong and Hooghly than Dakshin Dinajpur or Alipurduar.

Then we projected the stats of covid-19 attacked per 1000 people, recoveries per 1000 attacked and deaths per 1000 attacked. This is very useful measure. we can analyse the spreading rate, recovery rate and mortality rate. We can tighten the social distancing rules in the places with more spreading rate like North 24 pargana, Kolkata, Darjeeling. We should vaccinate the people of these places because most of them are potential carrier of the disease. From the data of recovery rate, we can see in which place's people have good immunity than others. People in these areas fight with covis-19 more efficiently. May be the average age group od these districts are lower than other districts or these people are maintaining healthy life styles. So, we can vaccinate this people after vaccinating other districts with lower recovery rate. Like we should vaccinate people from Howrah and Kolkata earlier than people from Jhargram .

From mortality rate data we can see that in which place people have died more. May be people from these places have lower immunity or the average age of this districts are greater than other states. People from this place needed vaccine more. We can see the despite of being highest COVID-19 spreading district the Mortality rate of North-24-pargana is not highest. But the mortality rate is highest in howrah though the spreading rate of howrah is not so much. We can see jhargram, is the healthiest city because spreading rate, recovery rate and mortality rate all are lower than others. But the overall COVID-19 situation is not good at Kolkata, Howrah or North -24-paragans. So, we should vaccinate this district fast than districts like Jhargram.

At last we calculated the rank of each districts respective their COVID-19 19 situation.We took three parameters Spreading rate, recovery rate and mortality rate. We ranked these three parameters and then we took the average of their respective ranks and then we ranked the calculated value again. Thus, we can visualise which district is better in overall COVID-19 situation. As we can see Jhargram is the best district to in covid-19 situation. Also districts like Purba Bardhhaman, Malda have controlled covid situation. But we saw that Kolkata, Haworah and North-24-paragana have worst COVID-19 situation, these districts are suffering more than any other districs in Covid. So, we can conclude that these districts need vaccine earlier than other districts

Data table

DISTRICTS	Population	Population per sq km	No.ofCovid Hospitals(pvt.)	No.ofCovid Hospitals(Govt.)	Population per Govt. Bed	Population per pvt. Bed
Alipurduar	1501983	478.94866	0	1	13654.39	0
Bankura	3596674	522.62046	0	1	11988.91	0
Birbhum	3502404	770.60594	0	4	10301.19	0
Cooch Behar	2819086	832.32536	0	2	14837.29	0
Dakshin Dinajpur	1976276	914.09621	0	2	17966.15	0
Darjeeling	1846823	586.4792	0	5	4355.715	0
Hooghly	5519145	1752.6659	0	8	6373.147	0
Howrah	4850029	3306.0866	0	7	3537.585	0
Jalpaiguri	3872846	1143.782	0	2	6553.039	0
Jhargram	1136548	374.1106	0	2	7576.987	0
Kalimpong	251642	234.08558	0	1	1677.613	0
Kolkata	14755000	79756.757	59	9	5797.642	4892.241
Malda	3988845	1068.536	0	4	12087.41	0
Murshidabad	7103807	1336.3068	0	6	10148.3	0
Nadia	5167600	1315.9155	0	3	9065.965	0
North 24 Parganas	10009781	2444.988	6	13	7741.517	31183.12
Paschim Medinipur	5913457	942.83434	0	9	6957.008	0
Paschim Bardhaman	2882031	1797.8983	1	2	7205.078	131001.4
Purba Bardhaman	4835532	890.02982	0	4	12725.08	0
Purba Medinipur	5095875	1075.9871	0	2	14559.64	0
Purulia	2930115	468.14427	0	3	13756.41	0
South 24 Parganas	8161961	1002.0824	0	7	7419.965	0
Uttar Dinajpur	3007134	957.07638	0	3	12274.02	0

DISTRICTS	Cases per 1000 people	Recovered per 1000 cases	Deaths per 1000 cases	Final Rank
Alipurduar	5.071296	981.3575	11.15925	11
Bankura	3.136787	957.0998	7.800035	7
Birbhum	2.713565	957.0707	8.838384	7
Cooch Behar	4.124032	961.9818	6.107002	6
Dakshin Dinajpur	4.077872	983.3726	8.934111	3
Darjeeling	9.550455	961.1634	11.16907	16
Hooghly	5.11909	955.8985	16.0337	20
Howrah	7.081813	950.3305	28.91082	22
Jalpaiguri	3.681272	958.8974	10.87185	12
Jhargram	2.58854	978.586	7.138001	1
Kalimpong	8.508119	964.9696	10.74264	13
Kolkata	8.284446	949.5652	23.96165	23
Malda	3.114937	963.7827	8.933602	3
Murshidabad	1.671076	958.386	12.21464	10
Nadia	4.14796	956.1465	13.1094	17
North 24 Parganas	11.54201	960.1326	19.90773	21
Paschim Medinipur	3.337811	957.5945	14.69247	14
Paschim Bardhaman	5.300776	951.6921	9.88414	17
Purba Bardhaman	2.514098	966.5213	7.567656	2
Purba Medinipur	3.917679	955.8706	13.62452	17
Purulia	2.3453	948.3411	6.69383	7
South 24 Parganas	4.387549	964.1451	18.56971	14
Uttar Dinajpur	2.125279	962.2907	11.10937	5

Conclusion

The all fields selected for the project are direct or indirect parameter of covid vaccination. The population and population density indicates the areas which are prone to be covid affected. The no of govt and private covid hospitals and no of beds in hospitals describes out health infrastructure of West Bengal. The population to beds ratio or the bed capacity is a major indicator of health infrastructure scenario of the state during the pandemic. The no of cases highlights the spreading areas where vaccination should be done first. The no of death cases per 1000 cases indicates the mortality rate. On the contrary, the no of recoveries per 1000 cases is related with the herd immunity gained by people in a district. All these are the important parameters for vaccination of covid-19. We expect that these data will help the authorities to arrange the regions of West Bengal during the vaccination process on the priority basis.

Acknowledgement

We would like to express our special thanks of gratitude to ISRO, IIT Bombay, AICTE and the all organiser and the co-ordinators of Mapathon 2020 for giving us this golden opportunity to do this analytical mapping project on the topic "Health infra, population, age group etc. for Vaccination." It would be impossible for us to complete the project work without their guidance. The webinars organised by ISRO, IIT Bombay and the online e-lectures by FOSSEE on QGIS helped us a lot to execute this project. This project gave us the scope to research in this alarming topic and we came to know about many new technological things.

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