

Analysis of COVID-19 Spread in India and its Different States

(Innovative Project Report on Business Analytics)

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Topic

How have political parties/alliances fared when it comes to the spread and control of covid-19 infection across the country?

Introduction

Coronavirus (**COVID-19**) pandemic broke out in Wuhan city of PRC (People's Republic of China), in December 2019. **Wei Guixian**, a 57 years old shrimp seller in wet market of Wuhan city was identified as "patient-zero".

The first case of covid-19 in India, identified on **30th January**, was a 20 year old female medical student of Kerala, who was studying in Wuhan city in Hubei province of PRC. On, **22nd march**, 2020, PM Modi declared a "voluntary" 14 hour public curfew across the country, which was met with overwhelmingly positive response by citizens. Subsequently, identified major-hotspots and all major cities were put under lockdown.

On **24th march**, 2020, PM Modi ordered the complete lockdown of country for 21 days, thus effectively putting 1.35 billion people under absolute lockdown, which was the largest restriction of its kind ever to be put into effect in history of humankind.

On **14th April**, the lockdown period was subsequently extended till **3rd may**, and then further till **1st June**.

From **1st June**, the government started to "unlock" the country in a phased manner in three unlock stages, except the containment zones. Around mid-May, almost half of the covid-19 infections were concentrated in 6 major cities of **Mumbai, Delhi, Ahmedabad, Chennai, Pune and Kolkata**. As per the reports of **10th September 2019**, Lakshadweep is the only part of the country, so far unaffected by covid-19 infections.

On **10th June, 2019**, number of recoveries in India exceeded the number of positive cases for the first time. **Around September**, infection rates started to come down, and a Government panel, **in October**, announced that the covid-19 had reached its peak in India and may be arrested under control by **February, 2021**.

Objective:

We intend to come out with following outcomes

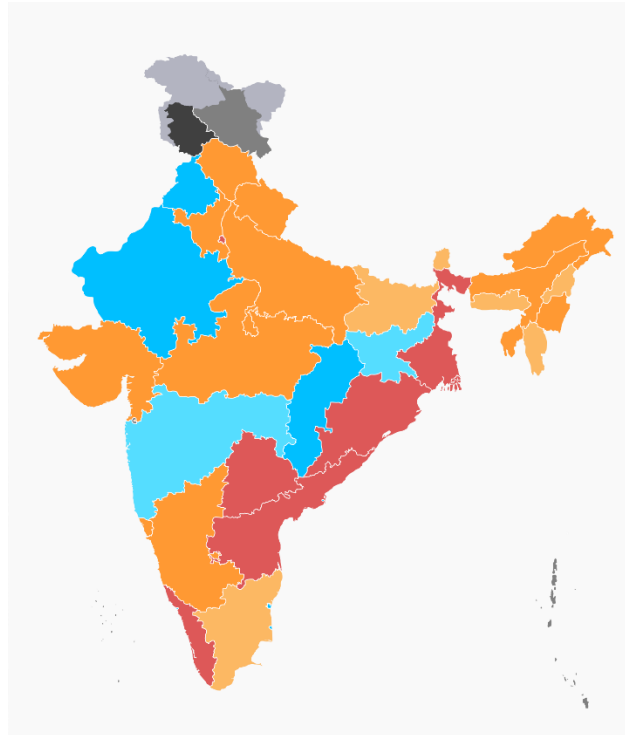
1. We intend to compare how various political parties/alliances have fared when it comes to containing covid19 spread and fatalities, in the respective states they are in power.
2. It is going to be a comparative study and we are going to compare performance of every party with each other, measured on defined paramters.

3. We also intend to compare the data with those of union territories which come directly under president rule.

Methodology:

We have decided certain parameters to measure and compare the performance of political parties in India. These factors are the following:-

1. Political party/alliance at the helm of affairs in the state. They have been divided into following:-
NDA, NON-NDA, UNION TERRITORIES, FLIPPED (where government change midway pandemic) and GOI (Government of Republic of India).
2. NDA includes these parties
 - ✓ Janata Dal (United)
 - ✓ Lok Janshakti Party
 - ✓ Apna Dal (Sonelal)
 - ✓ Jannayak Janata Party
 - ✓ All India Anna Dravida Munnetra Kazhagam
 - ✓ All Jharkhand Students Union
 - ✓ Nationalist Democratic Progressive Party
 - ✓ Rashtriya Loktantrik Party
 - ✓ Pattali Makkal Katchi
 - ✓ Asom Gana Parishad
 - ✓ Bodoland People's Front
 - ✓ Desiya Murpokku Dravida Kazhagam
 - ✓ Tamil Maanila Congress
 - ✓ Bharath Dharma Jana Sena
 - ✓ All India N.R. Congress
 - ✓ Maharashtrawadi Gomantak Party
 - ✓ Jana Sena Party
 - ✓ National People's Party
 - ✓ Mizo National Front
 - ✓ Sikkim Krantikari Morcha
 - ✓ Naga People's Front
 - ✓ Hindustani Awam Morcha (Secular)
 - ✓ Vikassheel Insaan Party
 - ✓ Yuvajana Sramika Rythu Congress Party
 - ✓ Telangana Rashtra Samithi
3. NON-NDA parties are the rest of parties.
4. Union territories are directly under president's rule.
5. Flipped states are the ones where government changed between NON-NDA and NDA parties, midway the pandemic period.



Orange/light orange: - NDA
 Blue/light blue and Maroon: - NON NDA
 Black and grey: - UNION TERRITORIES

To measure and compare the performances, we have defined and selected certain statistical measures. They are the followings:-

1. Total number of cases in India.
2. Political party at helm of affairs in state.
1. Recovery rate, which is defined as: - **$[\text{recoveryrate} = \text{RECOVERIES} \div \text{positive}]$** .
 It is the percentage of covid-19 positive identified who have turned negative out of total number of people who were identified covid-19 positive in the first place.
 Ex: - 100 people were infected. 87 people turned negative. So the recovery rate would be 87 % $(87/100 \times 100)$.
3. Mortality rate, which is defined as: - **$[\text{mortalityrate} = \text{DEATHS} \div \text{positive}]$** , is identified as the percentage of covid-19 positive people who died because of covid-19.
 Ex: - there were 100 covid-19 positive people, out of which 73 died, so the mortality rate is 73% $(73/100 \times 100)$.
4. Testing rate per million, which is defined as: - **$[\text{tests} \div \text{population} \times 1000000]$** , is defined as the number of tests conducted in a state, divided by the total population of the state and multiplied by 1 million(1000000). So, it is basically number of covid-19 tests conducted on every 1 million people of the state. For ex, there were 23 tests conducted

and the population of the state is 100, the testing rate will be 230000 ($23/100 \times 1000000$) tests conducted on every 1 million people of the state.

5. Total population of India.
6. Infection rate per million, which is defined as: - **[positive ÷ tests × 1 000 000]**, it is defined as the number of people who turned out to be covid-19 positive out of total number of tests conducted in the state. For ex, 64 people were found to be positive and the number of tests conducted were 100, so the infection rate will be ($64/100 \times 100$).
7. Setting statecode (abbreviated state names) as factor.
8. State's caseload as percentage of total caseload in India, which is defined as: -

[CASES ÷ totalcases × 100], it is defined as the percentage share a state holds out of the total number of cases recorded throughout India. For ex, Himachal Pradesh recorded 34 cases and the total number of cases recorded throughout India are 100, so the share of caseload for Himachal Pradesh will be 34% ($34/100 \times 100$).

9. Total deaths in India.
10. State's share of mortality as percentage India's cumulative national mortality, which is defined as: - **[DEATHS ÷ totaldeath × 100]**. It is defined as the percentage of deaths a state recorded out of the total number of deaths recorded across the country. For ex, Arunachal Pradesh recorded 76 deaths and the total number of deaths recorded across the country are 100, so the share of mortality for Arunachal Pradesh is 76% ($76/100 \times 100$).

To implement the statistical analysis we have collected data from government sources. However ICMR releases only cumulative data for the number of tests conducted in country, for individual state's data we have collected the data from a website run by volunteers. The screenshot of the data is here:-

STATE										
A	B	C	D	E	F	G	H	I	J	K
STATE	CASES	RECOVERED	DEATHS	statecode	tests	positive	deaths	party	population	
1 Andaman	4527	4315	61	AD	102433	4494	60	union terr	417036	
2 Andhra Pr	852955	826344	6854	AP	8863340	846245	6814	non nda	53903393	
3 Arunachal	15758	14319	47	AR	338280	15581	94	nda	1570458	
4 Assam	210175	205247	961	AS	4926906	209388	952	nda	35607039	
5 Bihar	226669	218828	1179	BH	12374768	223346	1156	nda	1.25E+08	
6 Chandigar	15636	14381	246	CH	119635	15339	241	union terr	1158473	
7 Chhattisga	210004	188167	2562	CT	2068640	204202	2482	non nda	29436231	
8 Dadar & N	3285	3263	2	DN	72410	3194	2	union terr	615724	
9 Delhi	482170	430195	7519	DL	5262045	451382	7143	non nda	18710922	
10 Goa	45845	43533	659	GO	317230	45498	656	nda	1586250	
11 Gujarat	187078	170894	3794	GJ	6625876	183844	3779	nda	63872399	
12 Haryana	197952	176403	2011	HR	2900690	187777	1935	nda	28204692	
13 Himachal	29330	22161	424	HP	446752	27001	396	nda	7451955	
14 Jammu an	102159	94851	1580	JK	2551946	100351	1558	flipped	13606320	
15 Jharkhand	105935	101897	922	JH	3714582	105224	913	non nda	38593948	
16 Karnataka	860082	820590	11527	KK	9043217	853796	11453	nda	67562686	
17 Kerala	520418	441523	1848	KL	5249865	502719	1771	non nda	35699443	
18 Ladakh	7356	6289	89	LK	83113	7063	85	union terr	289023	
19 Madhya P	183057	170969	3083	MP	3227919	179951	3055	nda/non r	85358965	
20 Maharash	1744698	1612314	46881	MH	9600328	1731833	45560	non nda	1.23E+08	
21 Manipur	21636	18434	218	MN	377804	20957	202	nda	3091545	
22 Meghalay	10633	9518	100	MG	215624	10368	94	nda	3366710	

The statistical analysis has been done in Rstudio using R language. Following are the R-scripts implemented for the analysis and producing visualization of statistical results:-

1. Packages used in the script are:-ggplot2.
2. Loading the data file into Rstudio :-
covid<- read.csv(file.choose(), header= TRUE)
covid
cases<-covid\$CASES
cases
3. Calculating the total number of cases in India:-
totalcases<- sum(cases)/2
totalcases
4. Setting party vector as a FACTOR:-
covid\$party<- factor(covid\$party, levels = c("nda","non nda","union territory","flipped","GOI"))
levels(covid\$party)
5. Creating and adding recovery rate vector as a column to dataframe:-
covid\$recoveryrate<- covid\$RECOVERIES/covid\$positive*100
covid\$recoveryrate
6. Creating and adding mortality rate vector as a column to the dataframe:-
covid\$mortalityrate<- covid\$DEATHS/covid\$positive*100
covid\$mortalityrate
7. Creating and adding a testing rate vector as a column to the dataframe:-
covid\$testingrate<- covid\$tests/covid\$population*1000000
8. Calculating total population of India:-
indiapopulation<-sum(covid\$population/2)
indiapopulation
9. Creating and adding infection rate vector as a column to the dataframe:-
covid\$infectionrate<- covid\$positive/covid\$tests*1000000
covid\$infectionrate
10. Setting statecode as a FACTOR:-
covid\$statecode<- factor(covid\$statecode,levels = covid\$statecode)
levels(covid\$statecode)
11. Calculating percentage of cases vector for states and adding it to the dataframe :-
covid\$sharecases<- covid\$CASES/totalcases*100
covid\$sharecases
12. Calculating total number of deaths in India:-
totaldeath<- sum(covid\$DEATHS)/2
totaldeath
13. Adding share of deaths vector to the dataframe as a column:-
covid\$shareddeath<- covid\$DEATHS/totaldeath*100
covid\$shareddeath
14. Sorting data frame according to case share and creating a new sorted dataframe to run visualization command on it:-

```

covidcasesharesorted<-covid[order( covid[,grep("sharecases", colnames(covid))
),]
covidcasesharesorted
covidcasesharesorted$statecode<- factor(covidcasesharesorted$statecode,levels
= covidcasesharesorted$statecode)
levels(covidcasesharesorted$statecode)
covidcasesharesorted$party<- factor(covidcasesharesorted$party,
levels=c("nda","non nda","union territory","flipped","GOI"))
levels(covidcasesharesorted$party)

```

15. Producing the visualization for state wise case share:-

```

sharecaseshistogram <- ggplot(covidcasesharesorted,aes(statecode,sharecases,
fill=party))
sharecaseshistogram
sharecaseshistogram+stat_summary(geom = "bar")+ scale_fill_discrete(name =
"Party in power", labels = c("NDA", "NON-NDA","UNION TERRITORY","flipped",
"CENTRAL GOVERNMENT"))+ labs(y="PERCENT SHARE OF TOTAL CASES", x =
"STATE/UT CODES")+ggtitle("STATE WISE CASE
SHARES(%))+scale_fill_manual(values=c("Orange", "Green",
"Blue","Black","Brown"))

```

16. Sorting data according to mortality rate and creating a new dataframe to implement visualization command on it:-

```

covidmortalityratesorted<-covid[order( covid[,grep("mortalityrate",
colnames(covid))],)]
covidmortalityratesorted
covidmortalityratesorted$statecode<-
factor(covidmortalityratesorted$statecode,levels =
covidmortalityratesorted$statecode)
levels(covidmortalityratesorted$statecode)
covidmortalityratesorted$party<- factor(covidmortalityratesorted$party,
levels=c("nda","non nda","union territory","flipped","GOI"))
levels(covidmortalityratesorted$party)

```

17. Producing the visualization for mortality rate:-

```

mortalityratehistogram<-ggplot(covidmortalityratesorted,
aes(statecode,mortalityrate,fill=party))
mortalityratehistogram
mortalityratehistogram+stat_summary(geom = "bar")+scale_fill_discrete(name =
"Party in power", labels = c("NDA", "NON-NDA","UNION TERRITORY","flipped",
"CENTRAL GOVERNMENT")) + labs(y="MORTALITY RATE AS % OF CASES
DETECTED", x = "STATE/UT CODES")+ggtitle("STATE/UT WISE MORTALITY
RATES(%))+scale_fill_manual(values=c("Orange", "Green",
"Blue","Black","Brown"))

```

18. Producing a sorted dataframe according to mortality share state/ut wise :-

```

covidmortalitysharesorted<-covid[order( covid[,grep("shardeath",
colnames(covid))],)]

```

```

covidmortalitysharesorted
covidmortalitysharesorted$statecode<-
factor(covidmortalitysharesorted$statecode,levels =
covidmortalitysharesorted$statecode)
levels(covidmortalitysharesorted$statecode)
covidmortalitysharesorted$party<- factor(covidmortalitysharesorted$party,
levels=c("nda","non nda","union territory","flipped","GOI"))
levels(covidmortalitysharesorted$party)

```

19. Producing a visualization on mortality shares of state/ut:-

```

shareddeathhistogram <- ggplot(covidmortalitysharesorted,
aes(statecode,shareddeath,fill=party))
shareddeathhistogram
shareddeathhistogram+stat_summary(geom = "bar")+scale_fill_discrete(name =
"Party in power", labels = c("NDA", "NON-NDA","UNION TERRITORY", "flipped",
"CENTRAL GOVERNMENT"))+ labs(y="PERCENT SHARE OF TOTAL DEATHS ", x
= "STATE/UT CODES")+ggtitle("STATE WISE SHARES OF TOTAL NATIONAL
MORTALITY(%))+scale_fill_manual(values=c("Orange", "Green",
"Blue", "Black", "Brown"))

```

20. Infection rates of state/ut sorted and created as new dataframe on which visualization command is implemented:-

```

covidinfectionratesorted<-covid[order( covid[,grep("infectionrate",
colnames(covid))]) ,]
covidinfectionratesorted
covidinfectionratesorted$statecode<-
factor(covidinfectionratesorted$statecode,levels =
covidinfectionratesorted$statecode)
levels(covidinfectionratesorted$statecode)
covidinfectionratesorted$party<- factor(covidinfectionratesorted$party,
levels=c("nda","non nda","union territory","flipped","GOI"))
levels(covidinfectionratesorted$party)

```

21. Producing a visualization for state/ut wise infection rates:-

```

infectionratehistogram<-
ggplot(covidinfectionratesorted,aes(statecode,infectionrate,fill=party))
infectionratehistogram
infectionratehistogram+stat_summary(geom = "bar")+stat_summary(geom =
"bar")+ scale_fill_discrete(name = "Party in power", labels = c("NDA", "NON-
NDA","UNION TERRITORY","flipped", "CENTRAL GOVERNMENT"))+
labs(y="INFECTION RATE AS % OF TESTS CONDUCTED", x = "STATE/UT
CODES")+ggtitle("STATE/UT WISE INFECTION
RATES")+scale_fill_manual(values=c("Orange", "Green",
"Blue", "Black", "Brown"))

```

22. Sorting and producing a new dataframe of testing rates on which visualization command will be implemented:-


```

covidtestingratesorted<-covid[order( covid[,grep("testingrate", colnames(covid))],
),]
covidtestingratesorted
covidtestingratesorted$statecode<-
factor(covidtestingratesorted$statecode,levels =
covidtestingratesorted$statecode)
levels(covidtestingratesorted$statecode)
covidtestingratesorted$party<- factor(covidtestingratesorted$party,
levels=c("nda","non nda","union territory","flipped","GOI"))
levels(covidtestingratesorted$party)

```

23. Producing the visualization for testing rates state/ut wise:-

```

testingratehistogram<-ggplot(covidtestingratesorted,
aes(statecode,testingrate,fill=party))
testingratehistogram
testingratehistogram+stat_summary(geom = "bar")+stat_summary(geom = "bar")+
scale_fill_discrete(name = "Party in power", labels = c("NDA", "NON-
NDA","UNION TERRITORY","flipped", "CENTRAL GOVERNMENT"))+
labs(y="TESTING RATE PER MILLION", x = "STATE/UT
CODES")+ggtitle("STATE/UT WISE TESTING
RATES")+scale_fill_manual(values=c("Orange", "Green",
"Blue","Black","Brown"))

```

24. Sorting recovery rates and creating a new dataframe on which visualization command will be implemented :-

```

covidrecoveryratesorted<-covid[order( covid[,grep("recoveryrate",
colnames(covid))],),]
covidrecoveryratesorted
covidrecoveryratesorted$statecode<-
factor(covidrecoveryratesorted$statecode,levels =
covidrecoveryratesorted$statecode)
levels(covidrecoveryratesorted$statecode)
covidrecoveryratesorted$party<- factor(covidrecoveryratesorted$party,
levels=c("nda","non nda","union territory","flipped","GOI"))
levels(covidrecoveryratesorted$party)

```

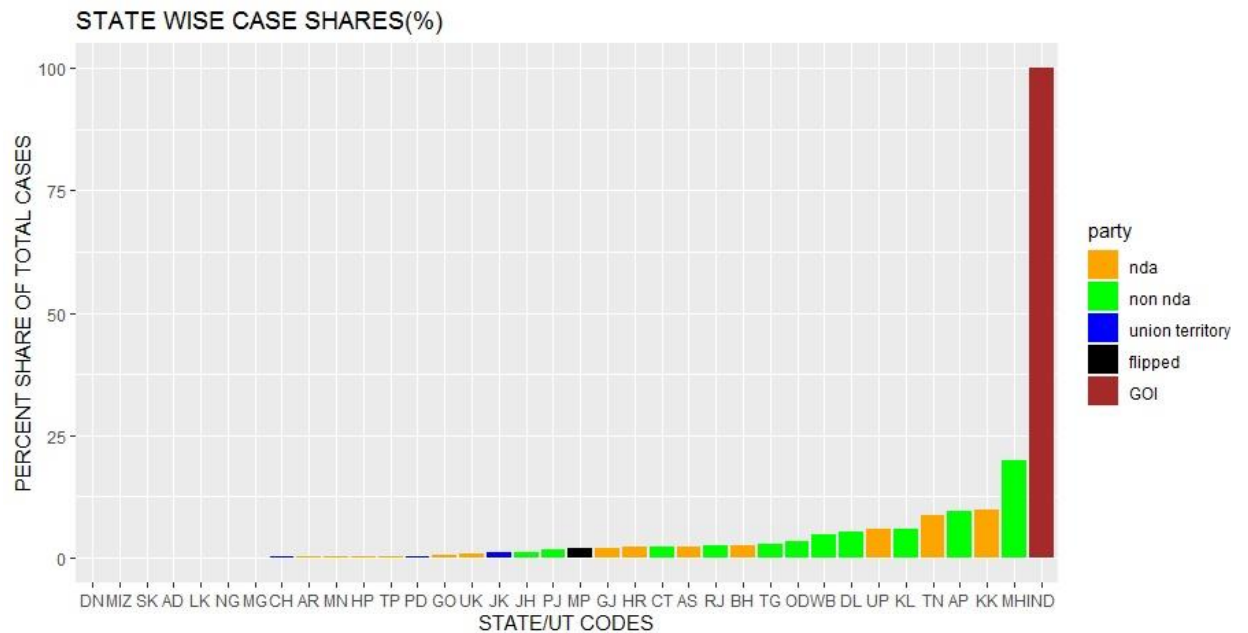
25. Producing the visualization for testing rates state/ut wise:-

```

recoveryratehistogram<-ggplot(covidrecoveryratesorted,
aes(statecode,recoveryrate,fill=party))
recoveryratehistogram
recoveryratehistogram+stat_summary(geom = "bar")+stat_summary(geom =
"bar")+ scale_fill_discrete(name = "Party in power", labels = c("NDA", "NON-
NDA","UNION TERRITORY","flipped", "CENTRAL GOVERNMENT"))+
labs(y="RECOVERY RATE AS % OF INFECTIONS", x = "STATE/UT
CODES")+ggtitle("STATE WISE RECOVERY RATES AS % OF
CASES")+scale_fill_manual(values=c("Orange", "Green",
"Blue","Black","Brown"))

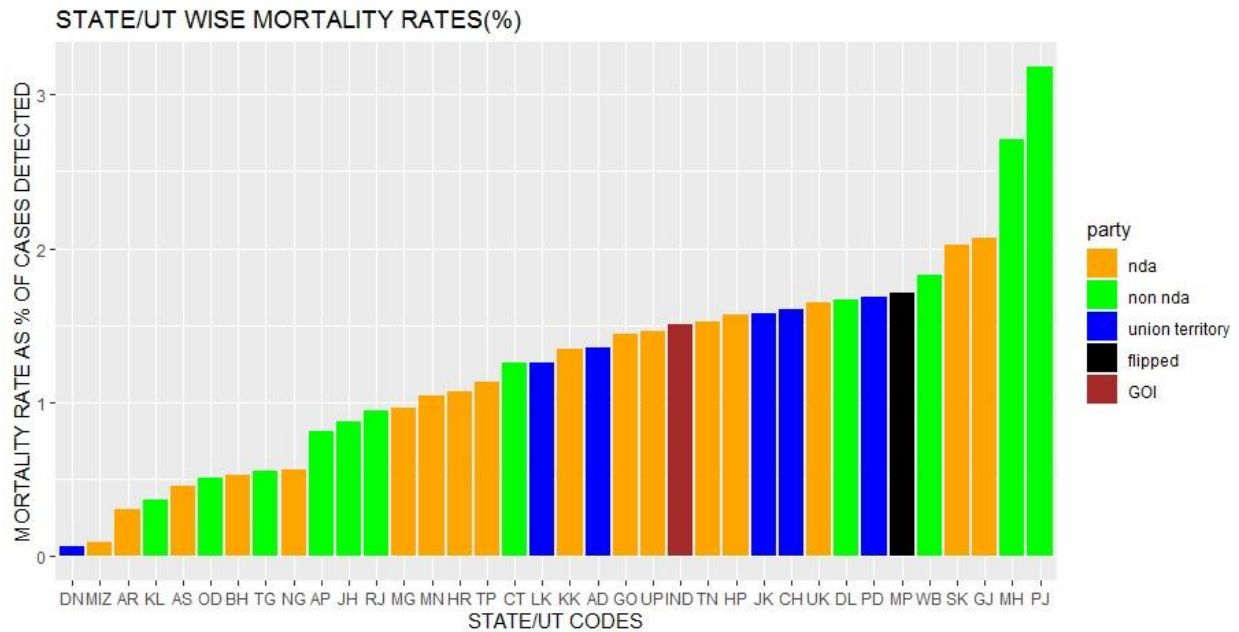
```

Conclusion:-



- As it is clearly visible, out of top ten states with highest share of caseloads, **7** states belong to **NON-NDA** parties and three states belong to **NDA**. However all **3** states belonging to **NDA** are among the top ten states with highest population in country, on the other hand out of 7 seven **NON-NDA** states, only **3** states belong to top ten states with highest population in country, rest **4** states do not, but still they feature in top with highest share of caseloads.

Featured NDA states' rank of populations	Featured NON-NDA states' rank of populations
Uttar Pradesh, 1 st	Maharashtra, 2 nd
Karnataka, 8 th	Andhra Pradesh, 10 th
Tamilnadu, 6 th	West Bengal, 4 th
	Kerala, 13 th
	Delhi, 19 th
	Odisha, 11 th
	Telangana, 12 th



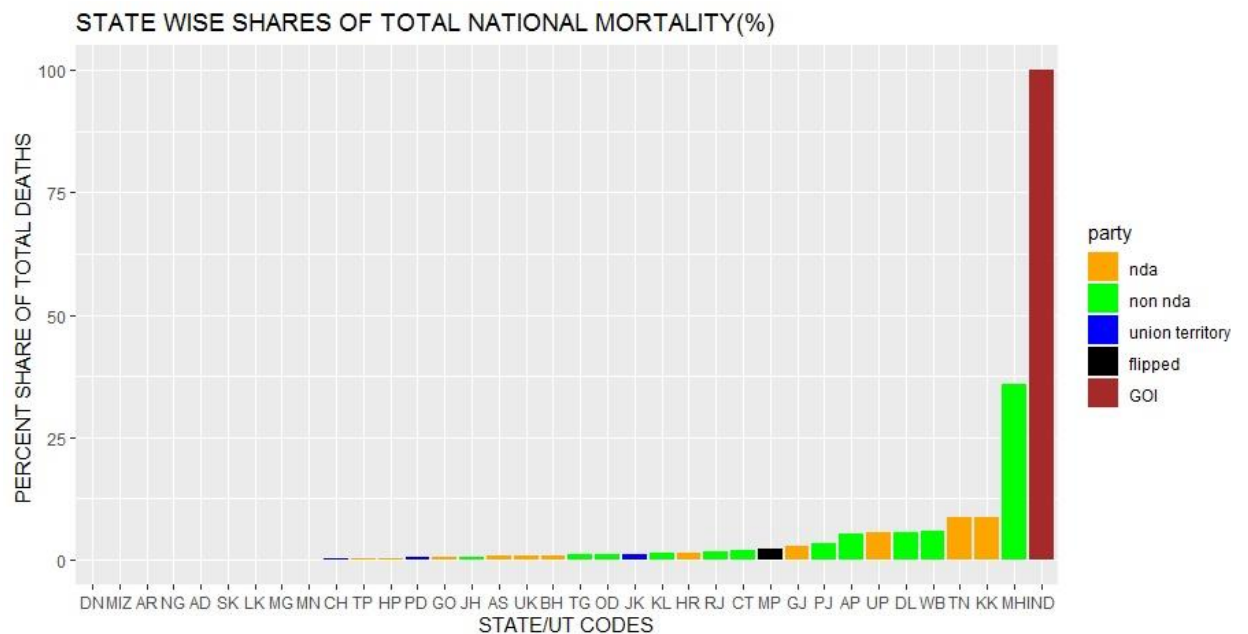
2. Among the top ten states with highest mortality rates, 4 belong to **NON-NDA** parties while 3 belong to **NDA** parties, and one(**Madhya Pradesh** flipped midway between pandemic), so we can divide **MP** as “0.5 state” among **NDA** and **NON-NDA**. This finally results in **3.5 NDA** states and **4.5 NON-NDA** states.

NDA states among top ten mortality rates	NON-NDA states among top ten mortality rates
Gujarat	Punjab
Sikkim	Maharashtra
Uttarakhand	West Bengal
Madhya Pradesh(0.5 state) *	Delhi
	Madhya Pradesh(0.5 state)*

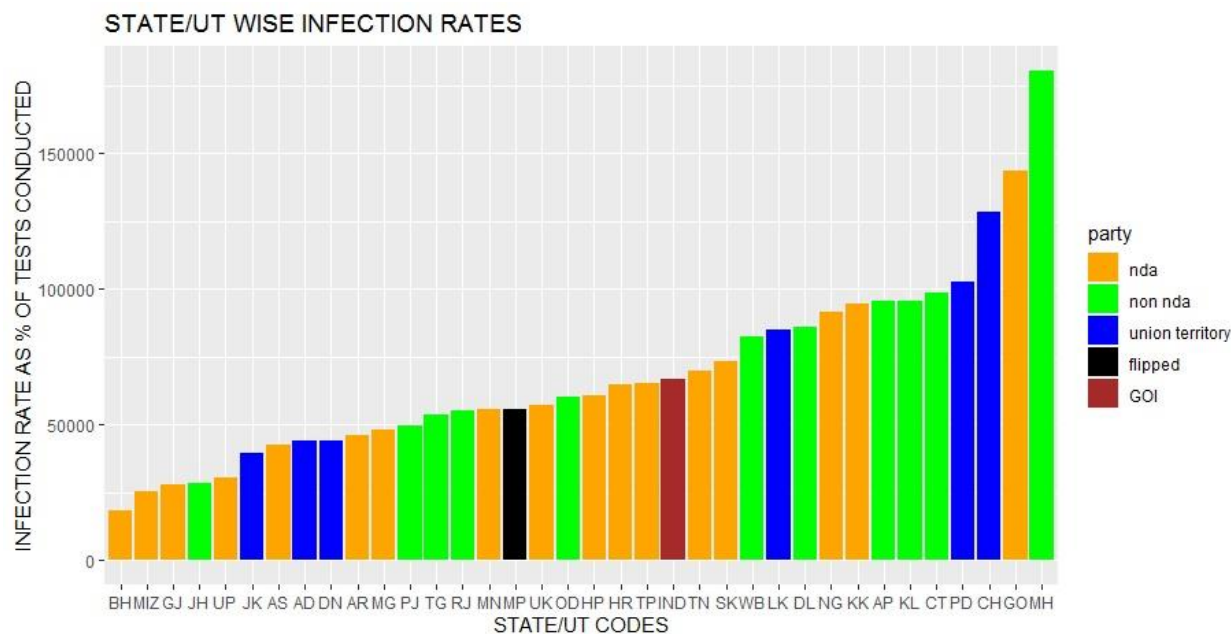
Now, across India, NDA is in power in 17.5 states, while NON-NDA parties are in power in 11.5* states for this pandemic period. This results in **20 % (3.5/17.5) NDA states** and **39.13% (4.5/11.5) NON-NDA states** featuring among **top 10 states with highest mortality rates**.

NDA STATES ABOVE NATIONAL MORTALITY	NON-NDA STATES ABOVE NATIONAL MORTALITY
Tamilnadu	Punjab
Himachal Pradesh	Maharashtra
Uttarakhand	West Bengal
Sikkim	Delhi
Gujarat	Madhya Pradesh(0.5 state)*
Madhya Pradesh(0.5 state)*	

Another observation is, despite **NDA** being in power in **1.52 (17.5/11.5)** times the number of states compared to **NON-NDA** parties, the percentage of NDA and NON-NDA states above National Mortality rates is almost equal, being **31.42% (5.5/17.5)** for **NDA** and **31.03% (4.5/11.5)** for **NON-NDA parties** respectively.



- Despite **NDA** being in power in **1.52 (17.5/11.5)** times the number of states compared to **NON-NDA** parties, among the top ten states according to percentage share of national covid related mortality, **4 NDA** states and **5 NON-NDA** states feature among top 10, the other state being **Madhya Pradesh** (flipped, hence divided as 0.5 among NDA &NON-NDA). However all **4** NDA states featuring in this list belong to top 10 states with highest population in country and only **3** NON-NDA states featuring in this list belong to top 10 states with highest population in country. This is a percentage of **25.71% (4.5/17.5)** for NDA and **47.82% (5.5/11.5)** for NON-NDA.



4. Among top ten states with highest infection rates, there are **3 NDA** and **5 NON-NDA** states, which translates to **17.14% (3/17.5)** and **43.47% (5/11.5)** states respectively for **NDA** and **NON-NDA** parties. Despite **NDA** being in power in **1.52 (17.5/11.5)** times the number of states compared to **NON-NDA** parties.

NDA parties among top 10 infection rates	NON-NDA parties among top 10 infection rates
Goa	Maharashtra
Karnataka	Chattisgarh
Nagaland	Andhra Pradesh
	Delhi

NDA has **5** parties and **NON-NDA** has **6** parties above national average infection rates, which translates to **28.57% (5/17.5)** for **NDA** and **52.17% (6/11.5)** for **NON-NDA** parties. Despite **NDA** being in power in **1.52 (17.5/11.5)** times the number of states compared to **NON-NDA** parties.

NDA parties above national average	NON-NDA parties above national average
Goa	Maharashtra
Sikkim	Chattisgarh
Nagaland	Andhra Pradesh
Karnataka	Kerala
Tamilnadu	West Bengal
	Delhi



5. Among top **10** states with highest testing rates, **3** belong to **NDA** and **3** belong to **NON-NDA**, which translates to **17.14%** (3/17.5) for NDA and **26.08%** (3/11.5) for **NON-NDA** parties.

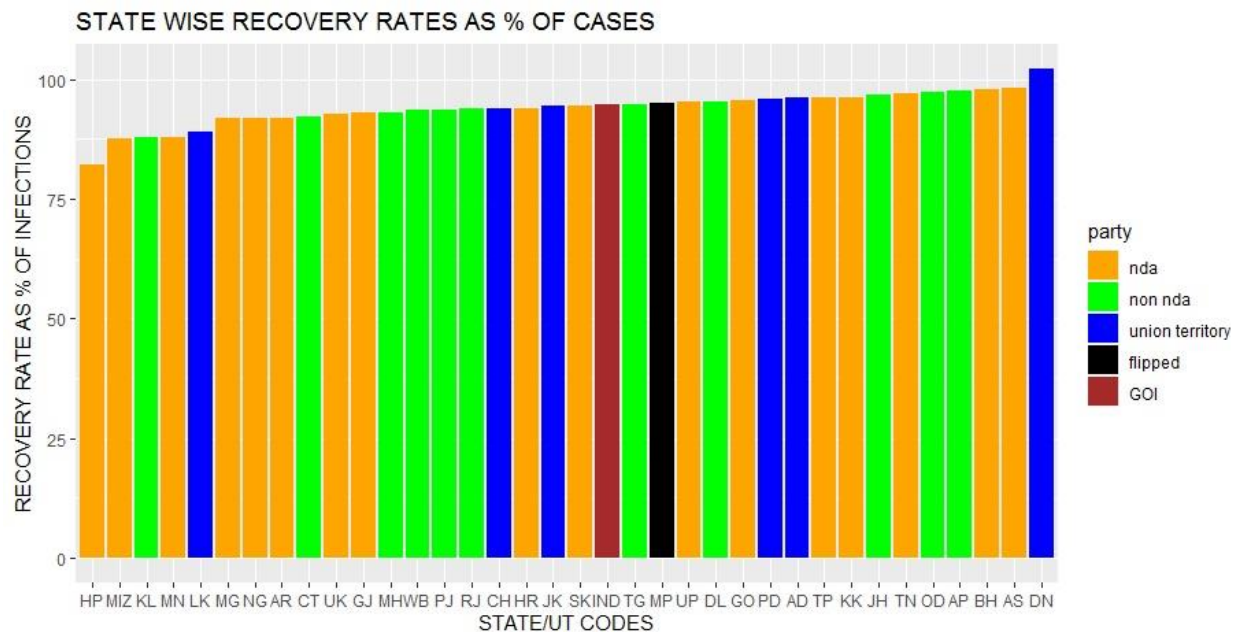
NDA states among top 10 testing rates	NON-NDA states among top 10 testing rates
Arunachal Pradesh	Delhi
Goa	Andhra Pradesh
Tamilnadu	Kerala

Among bottom **10** states with lowest testing rates, **5 NDA** states and **4 NON-NDA** states feature in the list, the other one being **Madhya Pradesh***, which translates to **31.42%** (5.5/17.5) for **NDA** and **39.13%** (4.5/11.5) for **NON-NDA** parties.

NDA states among bottom 10 testing rates	NON-NDA states among bottom 10 testing rates
Nagaland	Rajasthan
Himachal Pradesh	West Bengal
Meghalaya	Chattisgarh
Uttar Pradesh	Maharashtra
Sikkim	Madhya Pradesh(0.5)*
Madhya Pradesh(0.5)*	

Among the states above national testing rates, there are **12 NDA** states and **6 NON-NDA** states in this category, which translates to **68.57%** for **NDA** and **52.17%** for **NON-NDA** parties.

NDA states above national average	NON-NDA states above national average
Arunachal Pradesh	Delhi
Goa	Andhra Pradesh
Tamilnadu	Kerala
Assom	Telangana
Karnataka	Odisha
Manipur	Jharkhand
Tripura	
Uttarakhand	
Gujarat	
Haryana	
Mizoram	
Bihar	



6. Among top **10** states with highest recovery rates, **5** states belong to **NDA** and **3** states belong to **NON-NDA**, which translates to **28.57%** (5/17.5) for **NDA** and **26.08%** (3/11.5) for **NON-NDA** parties.

NDA states among top 10 recovery rates	NON-NDA states among top 10 recovery rates
Assam	Andhra Pradesh
Bihar	Odisha
Tamilnadu	Jharkhand
Karnataka	
Tripura	

Among the states with recovery rates above national average, **7** states belong to **NDA** and **5** states belong to **NON-NDA** parties, Madhya Pradesh also belongs to the list. This translates to **42.85%** (7.5/17.5) for **NDA** and **47.82%** (5.5/11.5) for **NON-NDA** parties.

NDA states above national average	NON-NDA states above national average
Assom	Andhra Pradesh
Bihar	Odisha
Tamilnadu	Jharkhand
Karnataka	Delhi
Tripura	Telangana
Goa	
Uttar Pradesh	

Madhya Pradesh ~ (0.5 state)*.

R-CODE:-

```
library(RcmdrMisc)
library(effects)
library(ggplot2)
library(reshape)
library(plyr)
library(rlang)
library(foreign)
library(Rcmdr)
library(splines)
covid<- read.csv(file.choose(), header= TRUE)
covid
cases<-covid$CASES
```


cases

#total number of cases in INDIA

totalcases<- sum(cases)/2

totalcases

#SETTING PARTY VECTOR AS FACTOR

**covid\$party<- factor(covid\$party, levels = c("nda","non nda","union
territory","flipped","GOI"))**

levels(covid\$party)

ADDING RECOVERY RATE VARIABLE FOR STATES TO DATAFRAME

covid\$recoveryrate<- covid\$RECOVERIES/covid\$positive*100

covid\$recoveryrate

ADDING MORTALITY RATE VARIABLE FOR STATES TO DATA FRAME

covid\$mortalityrate<- covid\$DEATHS/covid\$positive*100

covid\$mortalityrate

ADDING TESTING RATE VARIABLE FOR STATES TO DATAFRAME

covid\$testingrate<- covid\$tests/covid\$population*1000000

TOTAL POPULATION OF INDIA

indiapopulation<-sum(covid\$population/2)

indiapopulation

#ADDING INFECTION RATE VARIABLE FOR STATES TO DATAFRAME

covid\$infectionrate<- covid\$positive/covid\$tests*1000000

covid\$infectionrate

#SETTING STATECODE VARIABLE AS FACTOR

covid\$statecode<- factor(covid\$statecode,levels = covid\$statecode)

levels(covid\$statecode)

CALCULATING SHARE OF CASES FOR STATES

covid\$sharecases<- covid\$CASES/totalcases*100

covid\$sharecases

total deaths in INDIA

totaldeath<- sum(covid\$DEATHS)/2

totaldeath

```
#adding share of death rates for states variable to dataframe
```

```
covid$sharedeath<- covid$DEATHS/totaldeath*100
```

```
covid$sharedeath
```

```
#sorting data frame according to caseshare
```

```
covidcasesharesorted<-covid[order( covid[,grep("sharecases", colnames(covid))],),]
```

```
covidcasesharesorted
```

```
covidcasesharesorted$statecode<- factor(covidcasesharesorted$statecode,levels =  
covidcasesharesorted$statecode)
```

```
levels(covidcasesharesorted$statecode)
```

```
covidcasesharesorted$party<- factor(covidcasesharesorted$party, levels=c("nda","non  
nda","union territory","flipped","GOI"))
```

```
levels(covidcasesharesorted$party)
```

```
# share of cases per state
```

```
sharecaseshistogram <- ggplot(covidcasesharesorted,aes(statecode,sharecases, fill=party))  
sharecaseshistogram
```

```
sharecaseshistogram+stat_summary(geom = "bar")+ scale_fill_discrete(name = "Party in  
power", labels = c("NDA", "NON-NDA","UNION TERRITORY","flipped", "CENTRAL  
GOVERNMENT"))+ labs(y="PERCENT SHARE OF TOTAL CASES", x = "STATE/UT  
CODES")+ggtitle("STATE WISE CASE SHARES(%)") +scale_fill_manual(values=c("Orange",  
"Green", "Blue","Black","Brown"))
```

```
#sorting data frame according to mortalityrate
```

```
covidmortalityratesorted<-covid[order( covid[,grep("mortalityrate", colnames(covid))],),]
```

```
covidmortalityratesorted
```

```
covidmortalityratesorted$statecode<- factor(covidmortalityratesorted$statecode,levels =  
covidmortalityratesorted$statecode)
```

```
levels(covidmortalityratesorted$statecode)
```

```
covidmortalityratesorted$party<- factor(covidmortalityratesorted$party,  
levels=c("nda","non nda","union territory","flipped","GOI"))
```

```
levels(covidmortalityratesorted$party)
```

```
#mortality rates of states sorted
```

```
mortalityratehistogram<-ggplot(covidmortalityratesorted,  
aes(statecode,mortalityrate,fill=party))
```

```
mortalityratehistogram
```

```
mortalityratehistogram+stat_summary(geom = "bar")+scale_fill_discrete(name = "Party in  
power", labels = c("NDA", "NON-NDA","UNION TERRITORY","flipped", "CENTRAL  
GOVERNMENT")) + labs(y="MORTALITY RATE AS % OF CASES DETECTED", x = "STATE/UT
```

```
CODES")+ggtitle("STATE/UT WISE MORTALITY
RATES(%))"+scale_fill_manual(values=c("Orange", "Green", "Blue","Black","Brown"))
```

```
# share of mortalities sorted
covidmortalitysharesorted<-covid[order( covid[,grep("shareddeath", colnames(covid))]) ,]
covidmortalitysharesorted
covidmortalitysharesorted$statecode<-
factor(covidmortalitysharesorted$statecode,levels =
covidmortalitysharesorted$statecode)
levels(covidmortalitysharesorted$statecode)
covidmortalitysharesorted$party<- factor(covidmortalitysharesorted$party,
levels=c("nda","non nda","union territory","flipped","GOI"))
levels(covidmortalitysharesorted$party)
```

```
#share of mortalities per state
shareddeathhistogram <- ggplot(covidmortalitysharesorted,
aes(statecode,shareddeath,fill=party))
shareddeathhistogram
shareddeathhistogram+stat_summary(geom = "bar")+scale_fill_discrete(name = "Party in
power", labels = c("NDA", "NON-NDA", "UNION TERRITORY", "flipped", "CENTRAL
GOVERNMENT"))+ labs(y="PERCENT SHARE OF TOTAL DEATHS ", x = "STATE/UT
CODES")+ggtitle("STATE WISE SHARES OF TOTAL NATIONAL
MORTALITY(%))"+scale_fill_manual(values=c("Orange", "Green",
"Blue","Black","Brown"))
```

```
# infection rates of states sorted
covidinfectionratesorted<-covid[order( covid[,grep("infectionrate", colnames(covid))]) ,]
covidinfectionratesorted
covidinfectionratesorted$statecode<- factor(covidinfectionratesorted$statecode,levels =
covidinfectionratesorted$statecode)
levels(covidinfectionratesorted$statecode)
covidinfectionratesorted$party<- factor(covidinfectionratesorted$party,
levels=c("nda","non nda","union territory","flipped","GOI"))
levels(covidinfectionratesorted$party)
```

```
#infection rate of all states where covid affected
infectionratehistogram<-
ggplot(covidinfectionratesorted,aes(statecode,infectionrate,fill=party))
infectionratehistogram
infectionratehistogram+stat_summary(geom = "bar")+stat_summary(geom = "bar")+
scale_fill_discrete(name = "Party in power", labels = c("NDA", "NON-NDA", "UNION
TERRITORY", "flipped", "CENTRAL GOVERNMENT"))+ labs(y="INFECTION RATE AS % OF
```

```
TESTS CONDUCTED", x = "STATE/UT CODES")+ggtitle("STATE/UT WISE INFECTION  
RATES")+scale_fill_manual(values=c("Orange", "Green", "Blue", "Black", "Brown"))
```

```
#sorting testing rates of all states
```

```
covidtestingratesorted<-covid[order( covid[,grep("testingrate", colnames(covid))]) ,]
```

```
covidtestingratesorted
```

```
covidtestingratesorted$statecode<- factor(covidtestingratesorted$statecode,levels =  
covidtestingratesorted$statecode)
```

```
levels(covidtestingratesorted$statecode)
```

```
covidtestingratesorted$party<- factor(covidtestingratesorted$party, levels=c("nda", "non  
nda", "union territory", "flipped", "GOI"))
```

```
levels(covidtestingratesorted$party)
```

```
# testing rate of all states where data is collected
```

```
testingratehistogram<-ggplot(covidtestingratesorted,
```

```
aes(statecode,testingrate,fill=party))
```

```
testingratehistogram
```

```
testingratehistogram+stat_summary(geom = "bar")+stat_summary(geom = "bar")+
```

```
scale_fill_discrete(name = "Party in power", labels = c("NDA", "NON-NDA", "UNION  
TERRITORY", "flipped", "CENTRAL GOVERNMENT"))+ labs(y="TESTING RATE PER MILLION",
```

```
x = "STATE/UT CODES")+ggtitle("STATE/UT WISE TESTING
```

```
RATES")+scale_fill_manual(values=c("Orange", "Green", "Blue", "Black", "Brown"))
```

```
#sorting recovery rates of states
```

```
covidrecoveryratesorted<-covid[order( covid[,grep("recoveryrate", colnames(covid))]) ,]
```

```
covidrecoveryratesorted
```

```
covidrecoveryratesorted$statecode<- factor(covidrecoveryratesorted$statecode,levels =  
covidrecoveryratesorted$statecode)
```

```
levels(covidrecoveryratesorted$statecode)
```

```
covidrecoveryratesorted$party<- factor(covidrecoveryratesorted$party,  
levels=c("nda", "non nda", "union territory", "flipped", "GOI"))
```

```
levels(covidrecoveryratesorted$party)
```

```
#recovery rate sorted
```

```
recoveryratehistogram<-ggplot(covidrecoveryratesorted,
```

```
aes(statecode,recoveryrate,fill=party))
```

```
recoveryratehistogram
```

```
recoveryratehistogram+stat_summary(geom = "bar")+stat_summary(geom = "bar")+
```

```
scale_fill_discrete(name = "Party in power", labels = c("NDA", "NON-NDA", "UNION  
TERRITORY", "flipped", "CENTRAL GOVERNMENT"))+ labs(y="RECOVERY RATE AS % OF  
INFECTIONS", x = "STATE/UT CODES")+ggtitle("STATE WISE RECOVERY RATES AS % OF
```

```
CASES")+scale_fill_manual(values=c("Orange", "Green", "Blue", "Black", "Brown"))
```

DATA

Source of data:-

Official sources are:-

1. <https://www.mohfw.gov.in/>
2. <https://icmr.nic.in/node/39071>
3. <https://twitter.com/ANI>
4. <http://gis.ndma.gov.in/arcgis/apps/sites/#/data>
5. <https://covid.icmr.org.in/index.php>

For the number of tests conducted in various part of the nation we have looked into these sources:-

South

Tamil Nadu

1. <http://stopcoronatn.in/>
2. https://twitter.com/NHM_TN
3. <https://nhmtm.maps.arcgis.com/apps/opsdashboard/index.html#/095ad0a1c0254b058fa36b32d1ab1977>

Kerala

1. <http://dhs.kerala.gov.in/>
2. <https://dashboard.kerala.gov.in/>

Karnataka

1. <https://karunadu.karnataka.gov.in/hfw/kannada/Pages/covid-19.aspx>
2. <https://twitter.com/DHFWKA>
3. <https://covid19.karnataka.gov.in>

Telangana

1. <https://twitter.com/IPRTelangana>
2. <https://twitter.com/TelanganaHealth>
3. <http://124.124.103.93/COVID/home.htm>
4. <https://covid19.telangana.gov.in/announcements/media-bulletins/>

Andhra Pradesh

1. <https://twitter.com/ArogyaAndhra>
2. http://hmfw.ap.gov.in/covid_dashboard.aspx
3. http://covid19.ap.gov.in/Covid19_Admin/

Andaman and Nicobar Islands

1. <https://twitter.com/ChetanSanghi>
2. <https://dhs.andaman.gov.in/>

Mahe

1. <https://mahe.gov.in/covid-19/>

Puducherry

2. <https://collectorate.py.gov.in/Corona%20COVID-19.htm>
3. <https://covid19dashboard.py.gov.in/>

WEST

Maharashtra

1. <https://arogya.maharashtra.gov.in/1175/Novel--Corona-Virus>
2. <https://phdmah.maps.arcgis.com/apps/opsdashboard/index.html#/2cc0055832264c5296890745e9ea415c>
3. https://twitter.com/Maha_MEDD

Goa

1. <https://www.goa.gov.in/covid-19/>
2. <https://twitter.com/visrane>
3. <https://nhm.goa.gov.in/>
4. https://twitter.com/DHS_Goa

Madhya Pradesh

1. <http://mphealthresponse.nhmmp.gov.in/covid/>
2. <https://twitter.com/JansamparkMP>
3. https://www.mpinfo.org/COVID-19/COVID-19_Index.aspx

Gujarat

1. https://twitter.com/MoHFW_GUJARAT
2. <https://twitter.com/GujHFWDept>
3. <http://gujcovid19.gujarat.gov.in/>

Dadar & Nagar Haveli

1. <https://twitter.com/CollectorDnh/>
2. <https://twitter.com/DnhPublicity>
3. https://dddccovid19.in/report_bulletin

NORTH

Delhi

1. http://health.delhigovt.nic.in/wps/wcm/connect/DoIT_Health/health/home/covid19
2. <https://twitter.com/CMODelhi>
3. <https://delhifightscorona.in/>

Haryana

1. <http://www.nhmharyana.gov.in/page.aspx?id=208>

JK

1. <https://twitter.com/kansalrohit69>
2. <https://twitter.com/diprjk/>

Ladakh

1. <http://covid.ladakh.gov.in/#dataInsights>
2. <https://twitter.com/ladags>
3. https://twitter.com/DIPR_Leh
4. https://m.facebook.com/story.php?story_fbid=188115659312678&id=114874993303412

Himachal Pradesh

1. https://twitter.com/nhm_hp
2. <http://www.nrhmhp.gov.in/>

Rajasthan

1. <http://www.rajswasthya.nic.in/Corona%20Virus.htm>
2. <https://twitter.com/PIBJaipur>
3. <http://www.rajswasthya.nic.in/>

Punjab

1. <https://twitter.com/kbssidhu1961>
2. <http://pbhealth.gov.in/media-bulletin.htm>
3. http://gis-prsc.punjab.gov.in/covid/Punjab_level.aspx
4. <https://corona.punjab.gov.in/>

Uttar Pradesh

1. [N/A](#)

Chandigarh

2. <http://chdcovid19.in/>
3. <https://twitter.com/PIBChandigarh>

Uttarakhand

1. <http://health.uk.gov.in/pages/display/140-novel-corona-virus-guidelines-and-advisory->
2. <https://www.facebook.com/UKMedicalHealth/>
3. <https://www.facebook.com/UttarakhandDIPR/>
4. <https://twitter.com/PIBDehradun>

EAST

West Bengal

1. <https://www.wbhealth.gov.in/pages/corona/bulletin>

Mizoram

1. <https://health.mizoram.gov.in/posts>
2. <https://mcovid19.mizoram.gov.in/>
3. <https://twitter.com/ZoramthangaCM>
4. https://twitter.com/dipr_mizoram

Chhattisgarh

1. <http://www.cghealth.nic.in/cghealth17/>
2. <https://twitter.com/HealthCgGov>
3. https://twitter.com/TS_SinghDeo

Odisha

1. <https://twitter.com/HFWOdisha>
2. <https://health.odisha.gov.in/>
3. <https://health.odisha.gov.in/covid19-dashboard.html>

Bihar

1. <https://twitter.com/BiharHealthDept>
2. https://twitter.com/PIB_Patna
3. <https://twitter.com/sanjayjavin>

Assam

1. <https://twitter.com/himantabiswa>
2. https://twitter.com/nhm_assam
3. <https://covid19.assam.gov.in/all-districts/>

Arunachal Pradesh

1. <https://twitter.com/PemaKhanduBJP>
2. <http://covid19.itanagarsmartcity.in/covidstatus.php>
3. <https://twitter.com/DirectorateofHS>

Tripura

1. <https://twitter.com/BjpBiplab>
2. <https://tripura.gov.in/covid-test>
3. <https://covid19.tripura.gov.in/Visitor/ViewStatus.aspx>
4. <https://twitter.com/mygovtripura>

Jharkhand

1. <https://twitter.com/BannaGupta76/>
2. <https://mobile.twitter.com/FobGumla>
3. <https://mobile.twitter.com/RanchiPIB>

Manipur

1. http://nrhmmanipur.org/?page_id=2493
2. https://manipur.gov.in/?page_id=16984
3. <https://twitter.com/DiprManipur>
4. https://twitter.com/airnews_imphal

Meghalaya

1. <http://meghalayaonline.gov.in/covid/login.htm>
2. <https://corona.meghalayagov.in/>
3. <https://twitter.com/SangmaConrad>

Nagaland

1. <https://nagahealth.nagaland.gov.in/>
2. <https://covid19.nagaland.gov.in/>
3. <https://twitter.com/MyGovNagaland>
4. <https://twitter.com/pangnyu>
5. https://twitter.com/dipr_nagaland

Sikkim

1. <https://covid19sikkim.org/>
2. https://twitter.com/airnews_gangtok
3. <https://twitter.com/sikkimgovt>

Other miscellaneous sources:-

<https://www.covid19india.org/>

Twitter - <https://twitter.com/covid19indiaorg>

Instagram - <https://www.instagram.com/covid19indiaorg/>

Facebook - <https://facebook.com/covid19indiaorg/>

GitHub - <https://github.com/covid19india/covid19india-react>