

# Thwarting the Second Wave: Rapid Vaccination should be the primary tool and not Lockdown

**State Bank of India**

**23 April 2021**

**“Let all of us take a collective pledge today of insulating our country from COVID-19 through large scale vaccination:  
Its imperative for us to avert any further wave”**

- ❑ Current SBI FY22 projection at 11% real GDP (RBI: 10.5%) and 15% nominal GDP growth (Union Budget: 14.4%) for FY22 on the back of low base effect and renewed economic momentum
- ❑ However, given the current circumstances of partial/local/weekend lockdowns in almost all states, our growth forecast is now revised downwards
- ❑ Revised SBI FY22 projection now at 10.4% real GDP and 14.3% nominal GDP
- ❑ Total loss estimated at Rs 1.5 lakh crores, of which Maharashtra, Madhya Pradesh and Rajasthan account for 80%. Maharashtra alone at 54%

Probable Monetary Impact of Current Lockdowns in Various States			
States	FY22 Nominal GSDP (Rs lakh crore)	Type of Restrictions	Probable Impact (Rs crore)
Bihar	7.6	Night Curfew/Partial Lockdown	6222
Chhattisgarh	3.8	Lockdown in 20 districts till 26 April	7347
Gujarat	18.8	Night Curfew	-
Haryana	8.9	Night Curfew	-
Jharkhand	3.6	Lockdown for 8 days	2768
Karnataka	17.0	Night Curfew	-
Kerala	8.8	Night Curfew	-
Madhya Pradesh	11.3	Lockdown in 15 districts	21712
Maharashtra	29.8	Lockdown till 30 April	81672
Odisha	5.9	Weekend lockdown in Urban areas	1927
Punjab	6.1	Night Curfew/Partial Lockdown	4994
Rajasthan	12.0	Lockdown till 03 May	17237
Telangana	11.5	Night Curfew	-
Uttar Pradesh	21.7	Night Curfew	-
West Bengal	15.1	No Restrictions	-
Himachal Pradesh	1.7	No Restrictions	-
Uttarakhand	2.8	Weekend lockdown in 12 districts	914
Delhi	9.0	Lockdown for 6 days	5178
India	222.9	-	1,49,970

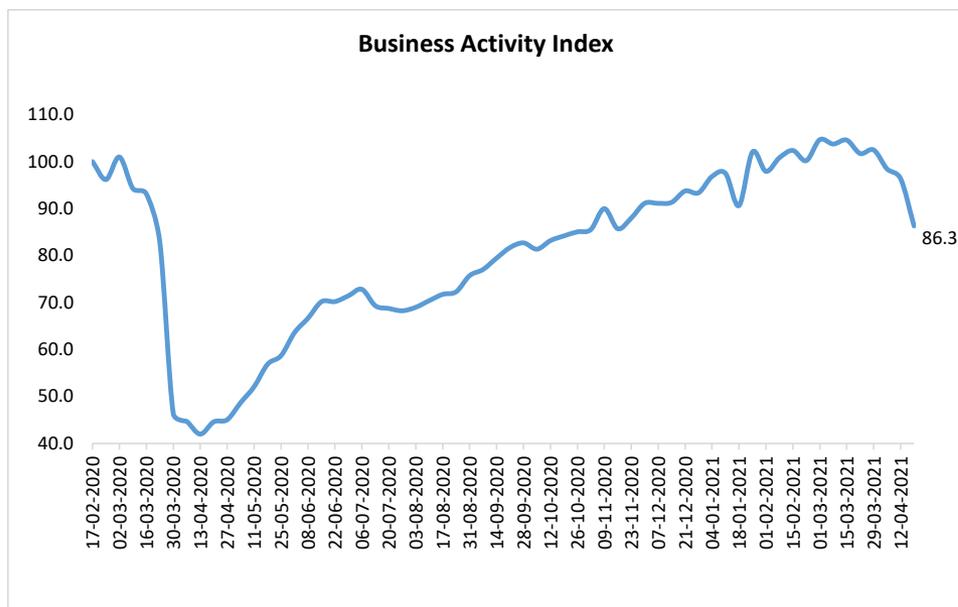
Source: SBI Research

- ❑ Maharashtra has put up a stringent lockdown among all states. Being the economically biggest and most industrialised state in India, this lockdown will have huge impact on growth
- ❑ Currently we estimate loss of around Rs 82,000 crore for Maharashtra which will definitely increase if restrictions are further tightened
- ❑ Given that R(0) is quite low for Maharashtra, it may be pertinent to ask that how much lockdown will slowdown the speed of infections, but for beefing up health infrastructure
- ❑ Migration of labour is continuing unabated. According to the data provided by Western Railways (for the period of 01-12 April), almost 4.32 lakh people have returned to the states like UP, WB, Bihar, Assam and Odisha from Maharashtra. Of 4.32 lakh, around 3.23 lakh reverse migrated to UP and Bihar alone. From Central Railways our estimate indicates that around 4.7 lakh reverse migrated to northern and eastern states from Maharashtra

Maharashtra's Share in	
India's GDP	13.9%
Number of workers	10.3%
Industrial projects approved	17.9%
Electricity consumption	12.9%
Vehicles sold	10%
Electronic and Home Appliances sales	18-20%
Smartphones	10%
Deposits	19.7%
Credit	26.1%

Migration of Labour from Maharashtra (1-12 April)		
	Western Railway	Central Railway
	Actual	Estimate
Total trains*	196	336
<i>of which, only UP &amp; Bihar</i>	150	-
Total Passengers	4.32 lakh	4.70 lakh
<i>of which, only UP &amp; Bihar</i>	3.23 lakh	-
Source: SBI Research; * to UP, WB, Bihar, Assam, Odisha		

- Various indicators show improvement in economic activity in Mar'21
- However, SBI business activity index shows decline in activity in Apr'21 with the latest reading for the week ended 19 Apr'21 of 86.3. This is the lowest in 5 months (16 Nov'21 when the value declined to 85.7)
- All the indicators have shown a dip with maximum decline in Apple mobility, weekly food arrival at Mandis and RTO revenue collection

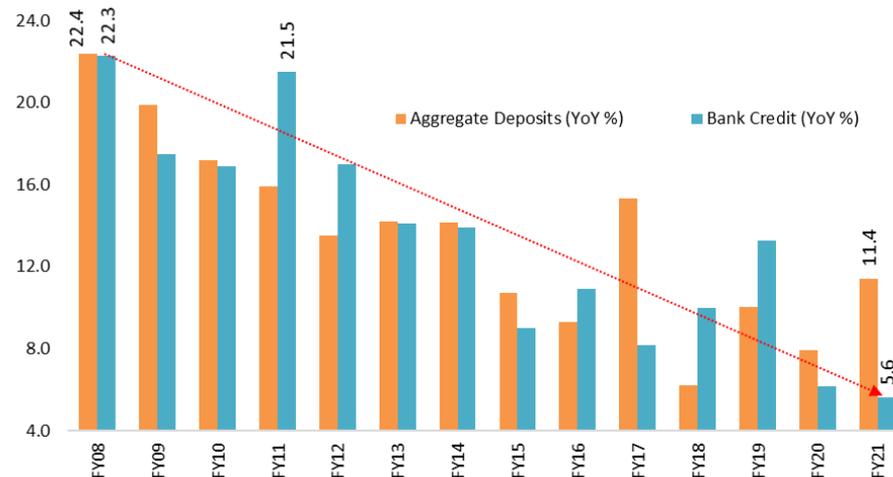


Leading Indicators MoM%				
Indicators	Dec-20	Jan-21	Feb-21	Mar-21
Google Mobility Index #				
Retail and Recreation	-1	3	2	1
Grocery and Pharmacy	0	-6	13	4
Transit stations	9	-10	15	-1
Workplaces	16	-32	39	-5
Residential	0	5	-9	2
Apple Mobility Index#	8	29	-8	-36
PMI Manufacturing#	0	1	0	-2
PMI Service#	-1	1	3	-1
SBI Yearly Index#	0	0	1	1
SBI Monthly Index#	-3	0	-5	-3
AQI (7 City Average)	15.4	1.0	-10.6	-13.0
No of Transactions at RTO	0.4	-0.8	-1.4	11.1
Revenue Collections at RTO	-12.5	9.0	-2.3	26.3
No of GST E way Bills Generated	11.2	-2.1	1.5	11.6
Electricity Demand	7.4	3.9	-5.1	18.2
Revenue Earning Freight Traffic of Major Commodity(Rs Cr)	10.5	0.3	-10.5	21.7
Port Cargo Traffic	6.7	1.5	-9.2	23.1
Tractor Sale Domestic	-25.6	27.9	-3.4	12.5
Domestic Passenger Vehicle Sale	-4.5	9.3	1.7	3.4
Domestic Two Wheelers Sale	-29.5	26.8	-0.2	4.9
Fertilizer Retail	12.5	-18.1	-24.4	-9.7
Weekly Food arrival in Tonnes-Average				
Cereals	-5.5	5.3	9.7	88.4
Pulses	60.7	168.3	39.7	-53.4
Fruits	-18.2	-17.9	13.7	23.9
Vegetables	21.9	13.5	9.7	2.7
Petrol Consumption	1.5	-3.5	-5.7	11.2
Diesel Consumption	2.0	-5.2	-3.7	10.1

Source: SBI Research, #Difference

## Banking Deposits have probably surged in April with people having no option to spend

- The banking sector has been affected with the tepid demand for credit in the H1FY21. However, thereafter credit offtake improved in H2, with the momentum picking up beginning October and registering a growth since November
- ASCBs credit growth has declined to a 59-year low of 5.6% in 2020-21, compared to 6.1% growth in 2019-20. On the other hand, deposits have increased to 11.4% in FY21, compared to 7.9% growth in FY20
- In FY21 Apr-May, huge monthly incremental increase in deposits was observed (particularly time deposits) as people had less options to spend due to nationwide lockdown. This time also we expect large traction in time deposits as most of the states imposed partial lockdowns



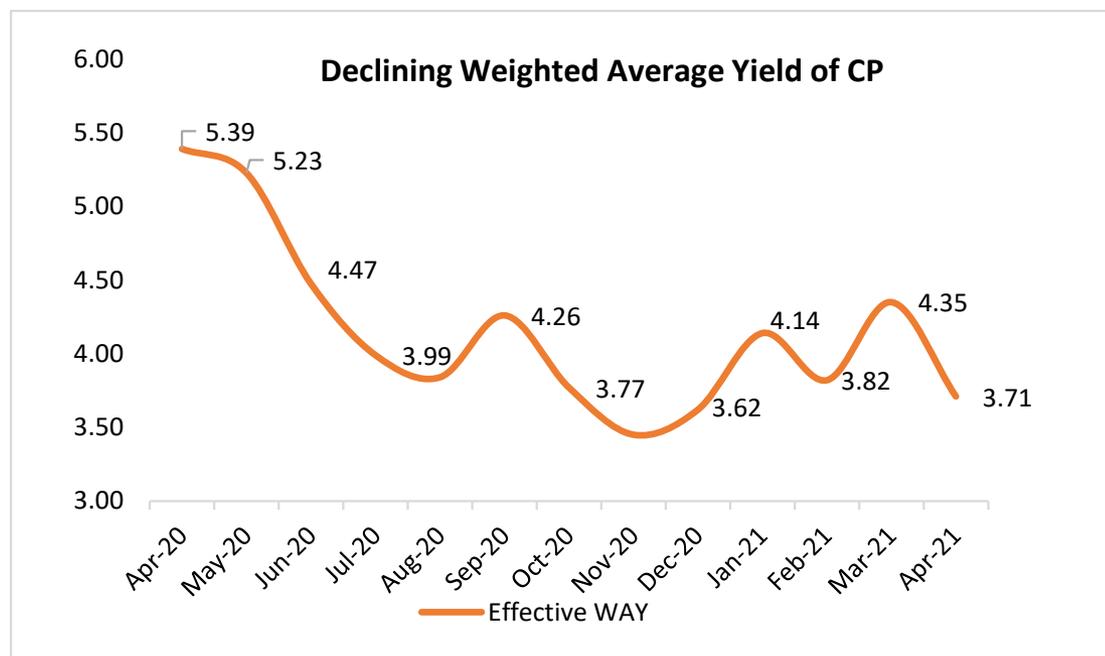
Deposits and Advances - Monthly Variation (Rs Bn)						
Products	Apr-20	Dec-20	Jan-21	Feb-21	Mar-21	Apr-21 (P)
<b>Aggregate deposits</b>	1471	1350	797	1358	1796	1743
<i>of which, Demand Deposits</i>	-1408	1065	87	1243	1581	1316
<i>Time Deposits</i>	2879	285	710	116	215	427
<b>Bank Credit</b>	-330	1986	83	702	1768	-755

Source: SBI Research; P: SBI Projections

- Early trend of around 45 listed entities suggests 10% growth in top line for listed entities while EBIDTA and PAT too grew by 16% and 26% in Q4FY21 as compared to Q4FY20
- Entities with less than Rs 100 crore reported 6% growth in net sales and negative PAT despite cut in employee expenses by 10%
- In Commercial paper market yield continue to be below 4% and decreased to 3.71% in Apr'21 against 4.35% in Mar'21

Growth in Key parameters Q4FY21 vis-à-vis Q4FY20				
Description	Net Sales	Employee Expenses	EBIDTA	PAT
Companies with turnover less than Rs 100 crore	6%	-10%	NTP	Negative
Companies with turnover of > Rs 100 cr and < Rs 500 cr	41%	9%	829%	1217%
Companies with turnover of > Rs 500 cr and < Rs 1000 cr	34%	-11%	90%	123%
Companies with turnover above Rs 1000 crore	10%	5%	14%	23%
Overall	10%	5%	16%	26%

Source: Cline; listed entities; SBI Research; NTP - negative to positive



## VACCINE UPDATE

- ❑ Spanish Flu in 1918 shows more deaths in later waves, thus vaccination is must to avoid larger fatalities later
- ❑ Injection to infection ratio shows that India made rapid improvement this year but it is still below Israel, Chile and UK
- ❑ Almost 900 million people atleast have received one dose of Covid-19 vaccine world-wide. However, top 15 countries accounted for 84% of total vaccination indicating huge unevenness
- ❑ Only 2.6% of population is fully vaccinated in the world, and in India only 1.2% of population is fully vaccinated till now
- ❑ Certain States like Rajasthan, Jammu & Kashmir, Haryana, Madhya Pradesh have lower percentage of their population above 45 years and have already given vaccine shots to larger percentage of population above 45 years. However, Tamil Nadu, Punjab, Andhra Pradesh and West Bengal have higher percentage of population above 45 years and have inoculated less proportion of those above 45 years
- ❑ Also, the state-wise performance in case of vaccination is quite uneven. Our “Vaccine Hesitancy Index” calculated as doses administered per 100 available shows that all N-E states and in states like Goa, Jharkhand, Assam, Delhi, Uttarakhand, Chhattisgarh there is a vaccine hesitancy
- ❑ Serum institute is expected to increase its production capacity to 110 mn doses per month by Jul’21, Bharat Biotech is expected to increase its production capacity to 12 mn doses per month by Jul’21. Also, Sputnik vaccine will be imported from May onwards. Taking these into account we believe a total of 1132 million doses can be given by Dec’21 in which 15% of the population can be fully vaccinated and 84% can get their first shot
- ❑ **Experience of other countries show infections stabilise after 15% of population receive second dose**
- ❑ Now that states are free to buy vaccine from manufacturers from 1 May, our estimate for 13 states shows that the cost of vaccine to inoculate is almost 15-20% of states’ health expenditure budget (assuming half of the population in these states will get vaccinated by Central Government), **still it will be only 0.1% of GDP**. This is significantly lower than **the economic loss in GDP due to lockdown which is already at 0.7% of GDP**

## IMPACT ON GDP

- ❑ Given the current circumstances of partial/local/weekend lockdowns in almost all states, SBI growth forecast is revised downwards. Revised SBI FY22 projection now at 10.4% real GDP and 14.3% nominal GDP

## COVID UPDATE

- ❑ Recovery rate across countries continues to improve in different peaks. But in India recovery rate increased to 97.3 till mid-Feb'21 but it has started declining thereafter and moved to 85 recently. Based on our model if we consider second wave peak is reached when recovery rate is around 78%-79%, then the peak could be further away in May
- ❑ Our model suggests that the estimated peak time is 96 days from 15-Feb, indicating the peak happening in the 3<sup>rd</sup> week of May. It may be noted that we are incrementally adding around 15000 more cases over peak of previous day as of today, though such numbers are difficult to predict
- ❑ UP and Maharashtra achieved peak before national peak in first wave. Now new cases in Maharashtra seems to be stabilising but share of cases in total of various other states (Chhattisgarh, MP, Gujarat) has increased in the current second wave and these are showing increase in daily new cases. **So, if other states also implement strict actions and control the spread, then national peak may come within 2 weeks after Maharashtra peak**
- ❑ Our statistical model indicates that India did remarkably well in containing COVID first wave, but as like in most other countries that faced unprecedented 2<sup>nd</sup> waves might have managed the 2<sup>nd</sup> wave better. States Contribution to the India's Estimated surge (as per our model) 31 Lakh cases after Jan'21, Maharashtra alone contributed 52% and 5 states contributed 75%
- ❑ 7-days moving average of fatality rate in the current second wave is higher than fatality rate at the time of first wave peak in case of Chhattisgarh, HP, Uttarakhand and Odisha
- ❑ In the current second wave, Maharashtra, Goa, Chhattisgarh, Delhi, Haryana are simultaneously having test positivity and high number of infections
- ❑ In the current second wave, Mobility & Cases both increased in UP & Karnataka in April, but conversely Mobility declined & and Cases increased in Chhattisgarh, Delhi and Maharashtra

**District wise**

- Share of top 15 districts in new cases have declined; but rural penetration has increased. Amongst the top 15 districts worst affected (mostly urban and only 2 are rural), 6 are from Maharashtra. Overall, these districts contribute around 25% to the National GDP. If we look at the rural districts worst affected, 9 are from Maharashtra followed by 3 from Chhattisgarh. These account for around 3.3% of the National GDP
- Also, if we see various districts where congregation was held (Kumbh, Election bound states and farmer protests) recently, have seen uptick in daily new cases in April, though of smaller magnitude

**ECONOMIC INDICATORS**

- SBI business activity index shows decline in activity in Apr'21 with the latest reading for the week ended 19 Apr'21 of 86.3. This is the lowest in 5 months (16 Nov'21 when the value declined to 85.7). All the indicators have shown a dip with maximum decline in Apple mobility, weekly food arrival at Mandis and RTO revenue collection
- ASCBs credit has declined to a 59-year low of 5.6% in 2020-21, compared to 6.1% growth in 2019-20. On the other hand, deposits have increased to 11.4% in FY21, compared to 7.9% growth in FY20
- In FY21 Apr-May, huge monthly incremental increase in deposits was observed (particularly time deposits) as people had less options to spend due to nation-wide lockdown. This time also we expect large traction in time deposits as most of the states imposed partial lockdowns
- Meanwhile, early trend of around 45 listed entities suggests 10% growth in top line for listed entities while EBIDTA and PAT too grew by 16% and 26% in Q4FY21 as compared to Q4FY20. Entities with turnover of less than Rs 100 crore reported 6% growth in net sales and negative PAT despite cut in employee expenses by 10%
- In Commercial Paper market yield continue to be below 4% and decreased to 3.71% in Apr'21 against 4.35% in Mar21

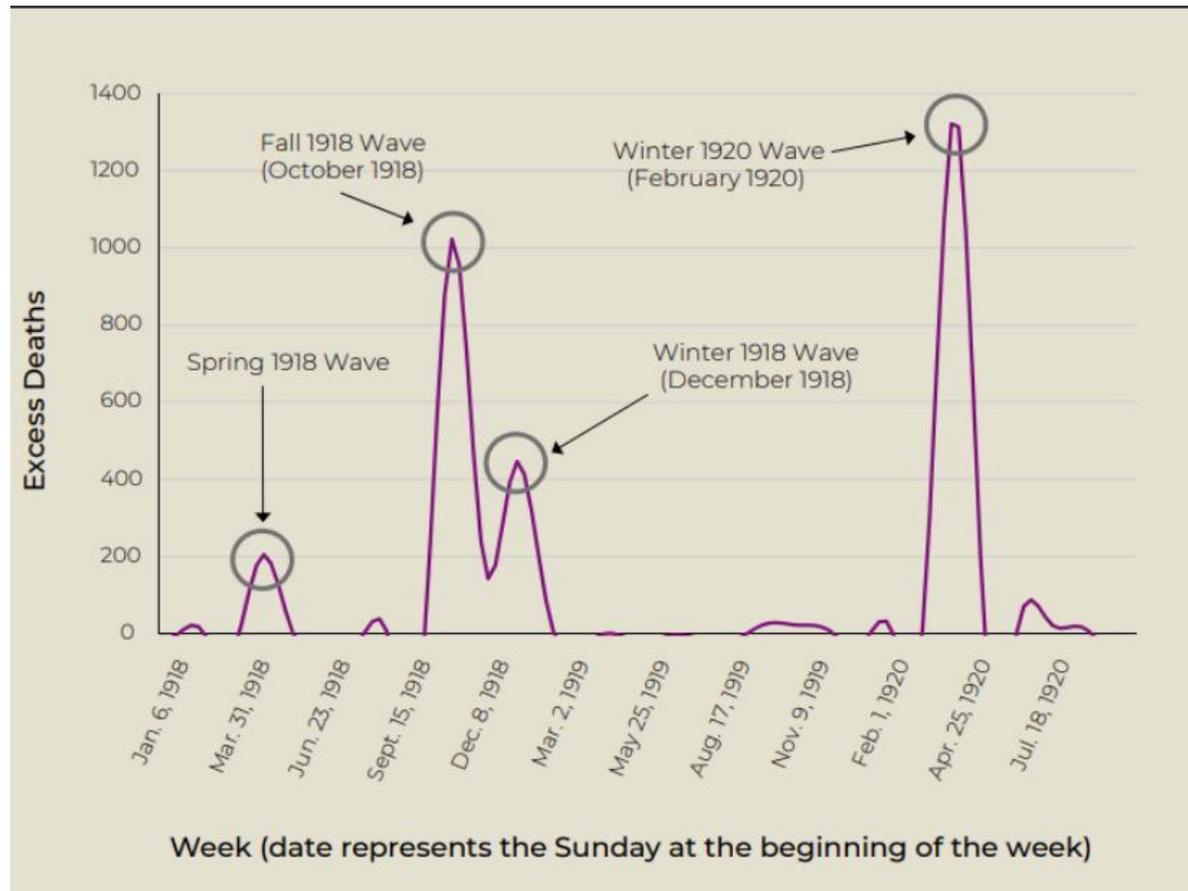
**OXYGEN UPDATE**

- All states should allow ambulance status to tankers so that they move faster, which will certainly help and reduce the transit time
- Government of India should analyse the oxygen data on a daily basis and direct supply. This is purely a supply chain optimization problem.

# Vaccination Update

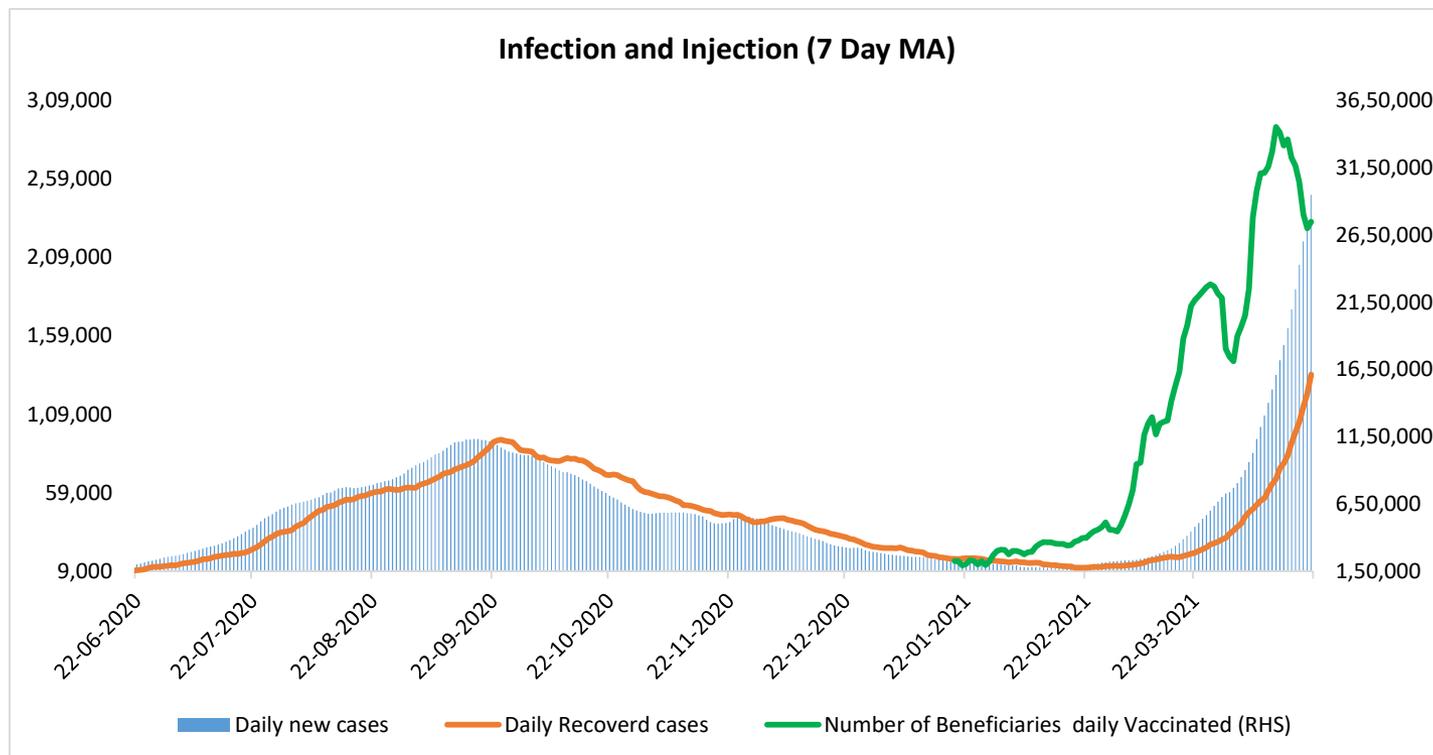
# Spanish flu (1918): Deaths had increased progressively in later waves

- Spanish Flu in 1918 had clearly shown more deaths in later waves thus vaccination is must to avoid larger fatalities later
- India must vaccinate its population with the single minded focus to achieve herd immunity and avoid any further waves as other countries are facing

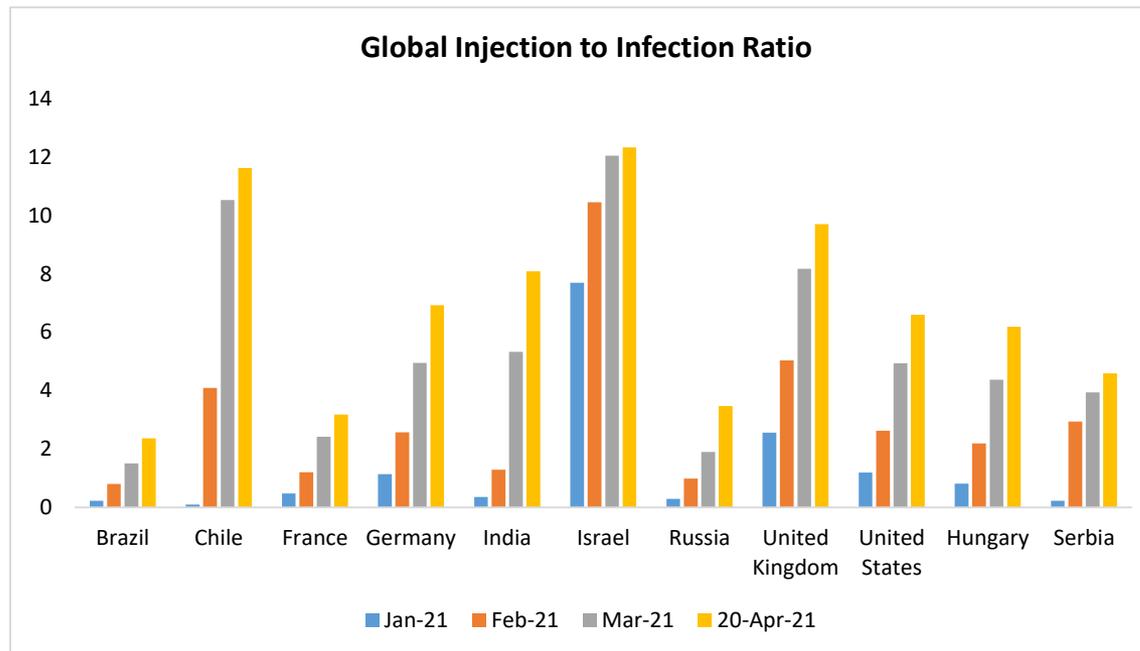


# India: Vaccination is witnessing slowing momentum.....

- India has been witnessing steep increase in daily cases which has exceeded daily recoveries since mid-March
- The number of beneficiaries vaccinated daily 34.1 lakh on 13 Apr'21 but has much declined since then

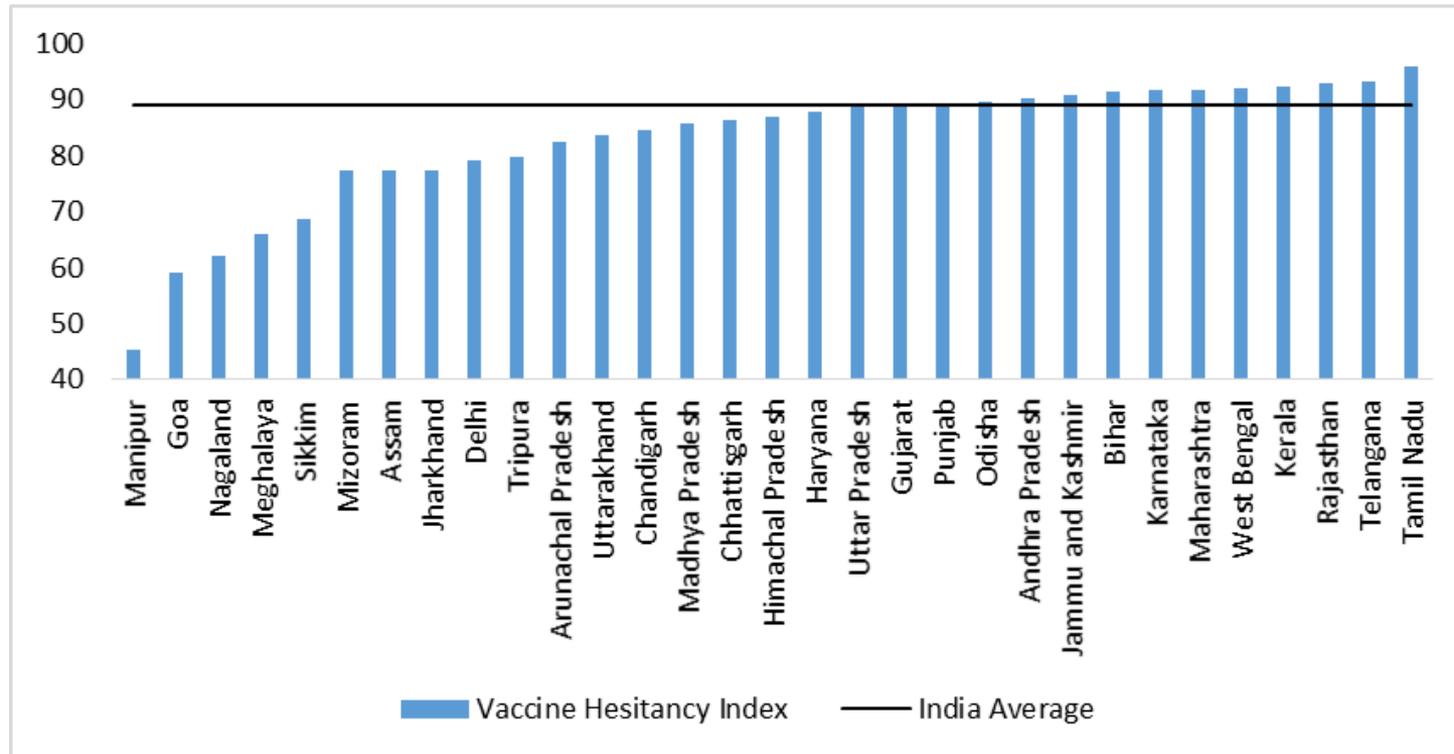


- Injection to infection ratio shows that India has made improvement this year but it is still below Israel, Chile and UK



# Initial Vaccine Hesitancy has not helped

- Though India has vaccinated almost 12.7 crore people, the state-wise performance is quite uneven
- Our “Vaccine Hesitancy Index” calculated as doses administered per 100 available show that all N-E states and in states like Goa, Jharkhand, Assam, Delhi, Uttarakhand, Chhattisgarh there is a vaccine hesitancy



## Current Status of Country-wise Vaccination

- ❑ Almost 900 million people at least received one dose of Covid-19 vaccine world-wide
- ❑ Top 15 countries has accounted for 84% of total vaccination indicating huge unevenness
- ❑ Only 2.6% of global population is fully vaccinated in the world, though some of the countries have fully vaccinated more than 25% of the population
- ❑ In India only 1.2% of population is fully vaccinated till now

Country-wise Vaccination Status			
Country	Total Vaccination (in Million)	Fully Vaccinated (% of population)	Doses administered per 100 people
US	209.4	25.2%	62.6
China	192.1	-	13.4
India	123.9	1.2%	9.0
UK	42.8	14.6%	63.0
Brazil	33.0	4.0%	15.5
Germany	22.0	6.6%	26.2
Turkey	20.0	9.2%	23.7
France	17.0	6.6%	25.0
Indonesia	16.7	2.1%	6.1
Russia	16.2	4.2%	11.0
Italy	15.2	7.4%	25.2
Mexico	14.2	3.0%	11.0
Chile	13.2	28.4%	68.8
Spain	12.3	7.1%	26.4
Israel	10.3	57.5%	119.3
Top 15	758.2	-	-
World	904.9	2.6%	11.6

Source: SBI Research

## Rajasthan, Gujarat, HP, Chhattisgarh have already given single dose of vaccine to a large %age of population above 45 years

- Certain States like Rajasthan, Jammu & Kashmir, Haryana, Madhya Pradesh though have lower percentage of their population above 45 years have already given vaccine shots to larger percentage of population above 45 years
- Even Himachal Pradesh, Gujarat and Uttarakhand have performed well
- However, Tamil Nadu, Punjab, Andhra Pradesh West Bengal, Haryana and Maharashtra have higher percentage of population above 45 years and have inoculated less proportion of those above 45 years: These states need to pick up pace

Age-wise population & vaccine doses				
State	45-59*		Above 60	
	% share of State's Population	% share of population vaccinated	% share of Total Population	% share of population vaccinated
KERALA	18.0	31.5	16.2	50.0
TAMIL NADU	16.0	16.7	13.3	15.2
HIMACHAL PRADESH	14.5	56.4	12.2	61.8
WEST BENGAL	14.1	25.9	11.1	31.3
PUNJAB	13.7	27.3	12.3	25.6
KARNATAKA	13.7	34.1	11.1	42.6
ODISHA	13.5	33.0	10.8	43.5
GUJARAT	13.3	48.4	9.9	56.5
ANDHRA PRADESH	13.3	26.9	12.0	25.2
MAHARASHTRA	13.2	33.3	11.5	35.0
DELHI	12.6	47.8	9.7	45.0
CHHATTISGARH	12.2	74.8	8.9	62.9
UTTARAKHAND	11.9	46.4	9.7	56.9
ASSAM	11.7	17.9	7.9	17.6
HARYANA	11.7	37.0	9.5	52.2
MADHYA PRADESH	11.4	35.5	8.3	41.9
JHARKHAND	11.2	26.6	8.4	34.4
JAMMU & KASHMIR	11.2	48.6	9.1	44.9
RAJASTHAN	11.0	49.1	8.2	75.8
UTTAR PRADESH	10.3	18.5	7.9	22.0
BIHAR	10.0	17.1	7.7	27.8
INDIA	12.4	30.3	9.7	36.4

\*People vaccinated in 45-59 group also includes some frontline and healthcare workers in 40-44 age group who have received vaccination

- ❑ The Government has now announced people above 18 years are now eligible to take vaccine from 1 May'21. This is a good move and certainly will help in combatting the rising infection in 2<sup>nd</sup> wave. However, India needs to increase its vaccination production
- ❑ Serum institute is expected to increase its production capacity to 110 mn doses per month by Jul'21, Bharat Biotech is expected to increase its production capacity to 12 mn doses per month by Jul'21. Also Sputnik vaccine will be imported from May onwards. Taking these into account we believe a total of 1132 million doses can be given by Dec'21 in which 15% of the population can be fully vaccinated and 84% can get their first shot
- ❑ Experience of other countries show infections stabilise after 15% of population receive second dose

Vaccine doses required to achieve stabilisation based on production capacity (in Million)								
	Daily Average	Doses Administered (Per Month)	Doses Administered (Cumulative)	Single Dose Administered	Single Dose (as % of GDP)	Fully Vaccinated	Fully Vaccinated (as % of Population)	Production Capacity
Till 20 Apr	-	-	127	110	8%	17.4	1.3%	-
Apr	3.2	96	223	193	14%	30.1	2.2%	75
May	3.5	109	332	286	21%	45.4	3.4%	85
Jun	3.7	111	443	381	28%	62.0	4.6%	105
Jul	4.5	140	582	501	37%	81.5	6.1%	150
Aug	4.5	140	722	621	46%	101.0	7.5%	150
Sep	5.0	150	872	745	56%	126.4	9.4%	150
Oct	5.0	155	1027	878	66%	148.9	11.1%	150
Nov	5.0	150	1177	1000	75%	176.5	13.2%	150
Dec	5.0	155	1332	1132	84%	199.7	14.9%	150

Serum 70 mn per month in April and expected to increase to 90 from July, Bharat 5 mn per month in April and expected to increase to 8 by July, Sputnik vaccine to be available from May

## Herd Immunity and uneven access of vaccine

- Herd immunity is a community protection that is created when a high percentage of the population is vaccinated. It provides a protective barrier, especially also for those *who cannot be vaccinated*. These include vulnerable groups such as babies too young to be vaccinated or immune-compromised children
- Herd immunity threshold for Covid-19 is expected at 60-70% but majority of scientists believe that *herd immunity may take longer than expected as there is uneven access of vaccine*
- 33% of the Covid-19 vaccines administered globally have gone to people in 25 wealthy nations that represent 11% of the global population. Countries making up the least-wealthy 11% have gotten just 1.6% of Covid-19 vaccines administered so far

Disease	Transmission	Herd Immunity Threshold
Measles	Airborne	92–95%
Pertussis	Airborne droplet	92–94%
Diphtheria	Saliva	83–86%
Rubella	Airborne droplet	83–86%
Smallpox	Airborne droplet	80–86%
Polio	Fecal-oral route	80–86%
Mumps	Airborne droplet	75–86%
SARS	Airborne droplet	50–80%
Ebola	Bodily fluids	33–60%
Influenza	Airborne droplet	33–44%
Covid-19	Airborne/Contact	60–70%

Source: SBI Research

	Vaccine Share %	Population Share%
Most Wealthy 25 countries	33.2%	10.9%
Most Wealthy 50 countries	46.2%	16.7%
Least Wealthy 25 countries	1.6%	11.8%
Least Wealthy 50 countries	17.0%	41.2%

- From 01 May, states are free to buy vaccine from manufacturers
- As per our estimate for 13 states, the cost of vaccine is almost 15-20% of states' health expenditure budget (assuming half of the population in these states will get vaccinated by Central Government)

Expenditure of Vaccination for States								
State	2021-22 (BE)	Growth (FY22 BE/ FY21 RE)	Vaccinate d till Now	Vaccinate by 30 Apr	18+ Population	Remaining population to be injected	Expected Cost	Vaccine cost as % of total Health Exp
	Rs crore	%	crore	crore	crore	crore	Rs crore	%
Bihar	13012	16.5	0.6	0.7	7.0	6.2	2492	19%
Chhattisgarh	5902	-9.5	0.5	0.6	1.8	1.3	504	9%
Gujarat	11304	0.6	1.1	1.3	4.5	3.2	1292	11%
Jharkhand	4445	2.5	0.3	0.4	2.3	2.0	780	18%
Karnataka	11157	13.3	0.8	1.0	4.6	3.6	1448	13%
Kerala	8782	10.2	0.6	0.8	2.6	1.8	700	8%
Madhya Pradesh	11619	22.7	0.8	0.8	5.1	4.3	1736	15%
Maharashtra	26432	22.1	1.3	1.6	8.5	6.9	2768	10%
Odisha	9340	6.4	0.5	0.6	3.1	2.4	968	10%
Rajasthan	16269	21.5	1.2	1.4	4.9	3.5	1380	8%
Uttar Pradesh	32009	55.5	1.1	1.3	13.9	12.6	5036	16%
West Bengal	12756	0.2	0.9	1.2	6.9	5.8	2312	18%
Uttarakhand	3189	49.9	0.2	0.2	0.7	0.5	209.6	7%
<b>Total of 13 States</b>	<b>166216</b>	<b>6.5</b>	<b>9.9</b>	<b>11.8</b>	<b>65.9</b>	<b>54.1</b>	<b>21626</b>	<b>13%</b>

Source: SBI Research

- ❑ The latest vaccine strategy divides the population into two buckets: 18- 44 and 45 & above
- ❑ Public immunisation will be confined to second bucket but is liberalised for all from 1-May
- ❑ The rapid immunisation will require augmenting production capacity
  - Current strategy incentivise production and FDI
- ❑ Present strategy excludes young, pregnant women and lactating mothers
- ❑ Adopting a cluster based approach for immunisation is advisable in initial stages
- ❑ Giving priority to vaccine that offers protection against multiple strain is advisable
- ❑ Good opportunity to incentivise local production of vaccine intermediate inputs / API under Production Linked Incentive Scheme

# COVID-19 Update

- To see statistically the state-wise infections, we tested a two stage least square (2-SLS) panel model with 20-major states considering the monthly data from April 2020 to April 2021. First, we regressed the state-wise test data on population to gauge the exact number of tests that should have been done given the population difference across states. Then the cases were regressed on such estimated test numbers arrived from equation 1

$$T = \alpha + \beta P \mu \dots(1)$$

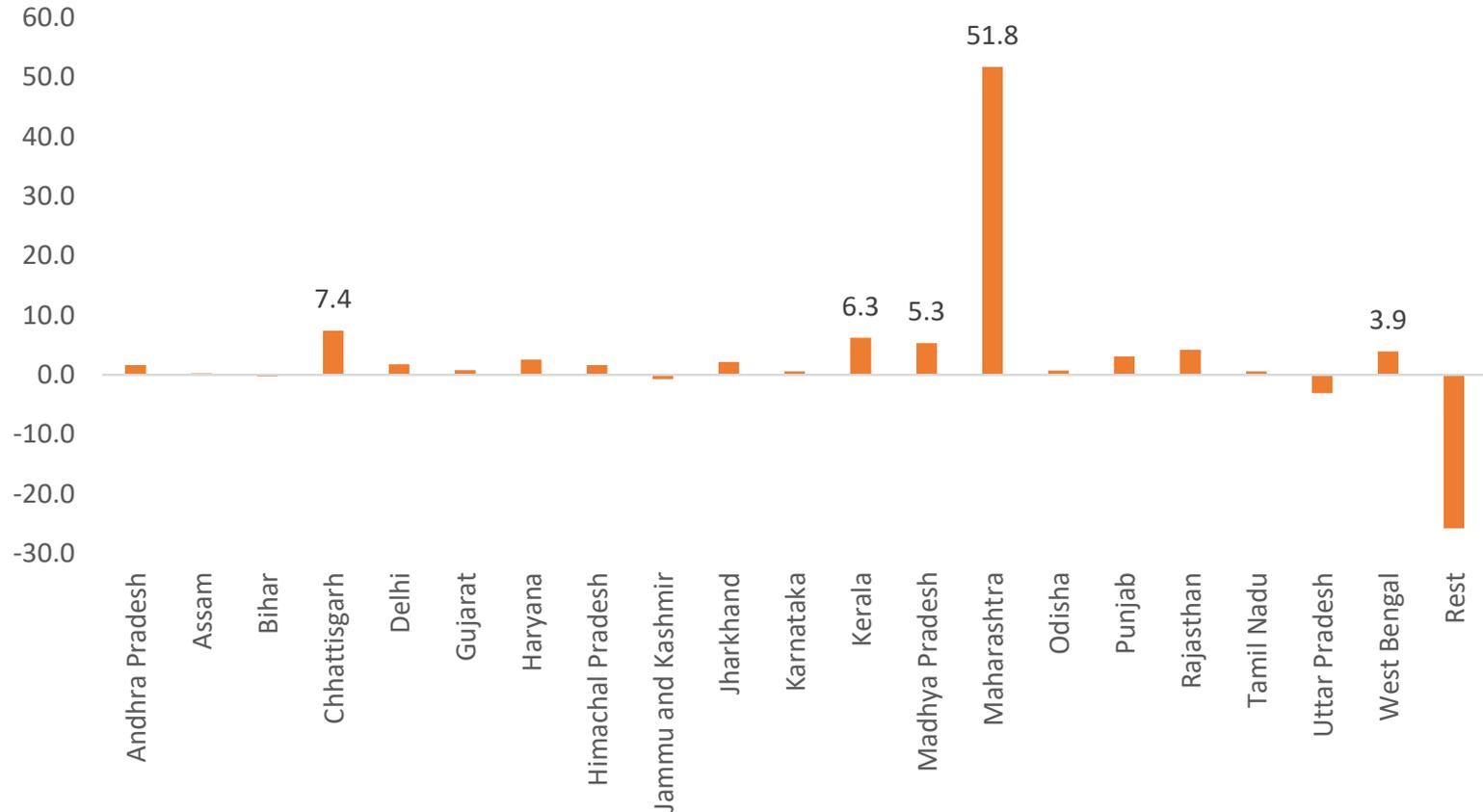
$$C = \sigma + \rho T + \epsilon \dots(2)$$

Where,  $T$  = Number of Test,  $P$  = Population,  $C$  = Confirmed Cases

- Both the estimated models are significant at 5% level and results indicate that for India the estimated confirmed cases number is 1.2 crore which is in fact 30 lakh lower than the actual confirmed cases of 1.5 crore. However, as of end-Jan'21, the estimated cases were just 81,620 more . In 2 ½ months, it has increased by 31 lakh new cases. Maharashtra has alone contributed 51% of the rise in numbers, followed by Chhattisgarh, Kerala, MP etc.
- Meanwhile, Uttar Pradesh, Bihar, Gujarat, Odisha and Jharkhand among others have managed the situation quite well with estimated model cases more than actual cases

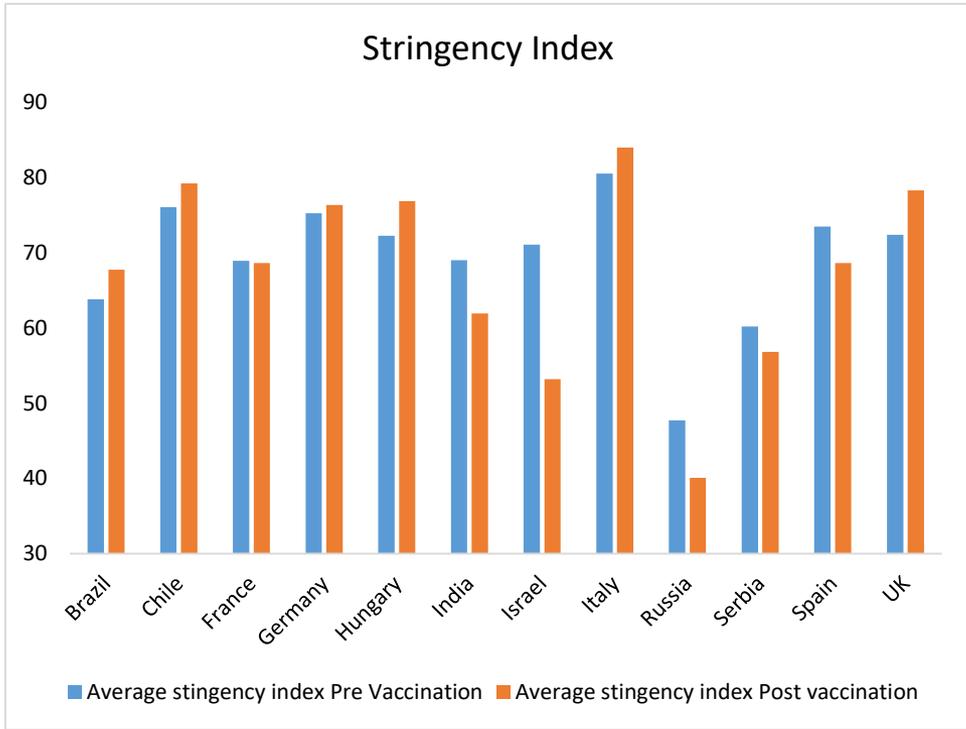
COVID-19 Cases: Actual vs Estimated				
States	Actual Cases	Actual minus Estimated Cases as of		Total Cases
		4/19/2021	1/31/2021	
Andhra Pradesh	968000	48597	213135	261732
Assam	225822	7928	-124661	-116733
Bihar	331604	-7604	-839698	-847302
Chhattisgarh	558674	223969	88359	312328
Delhi	877146	52662	68411	121073
Gujarat	415972	24586	-280267	-255681
Haryana	363813	77784	8197	85981
Himachal Pradesh	78070	49937	8921	58858
Jammu and Kashmir	148208	-22214	-116688	-138902
Jharkhand	167235	64205	-156190	-91985
Karnataka	1176850	18533	76459	94992
Kerala	1253069	188694	438191	626885
Madhya Pradesh	420977	160647	11234	171882
Maharashtra	3898262	1561220	1285216	2846437
Odisha	372703	22384	-47659	-25274
Punjab	304660	93025	-59988	33037
Rajasthan	426584	125984	52401	178385
Tamil Nadu	1002392	18360	-2092	16268
Uttar Pradesh	879831	-92698	-818393	-911091
West Bengal	668353	118813	177543	296356
Rest	776489	-777856	-64040	-841896
-' : Well Managed '+' : Badly Managed				

### State's Share (%) in India's Surge after Jan'2021



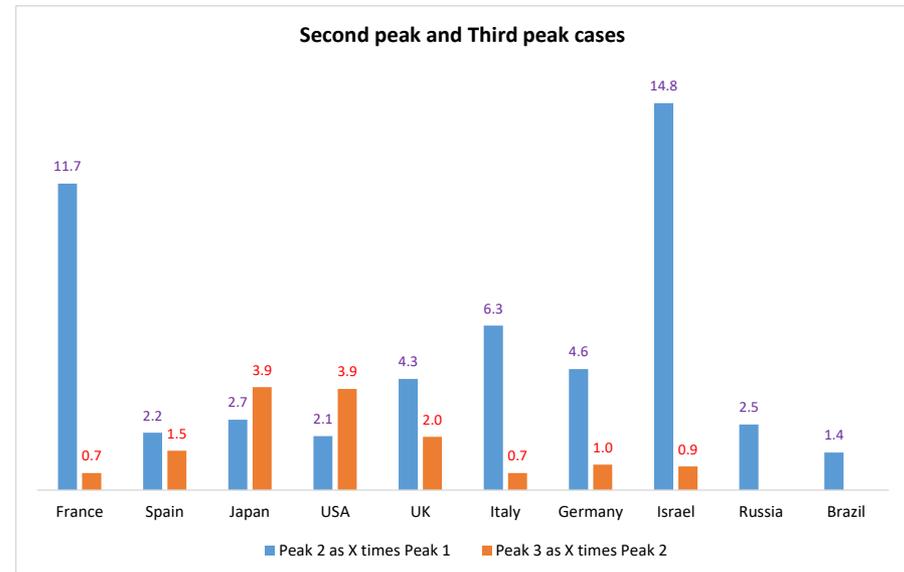
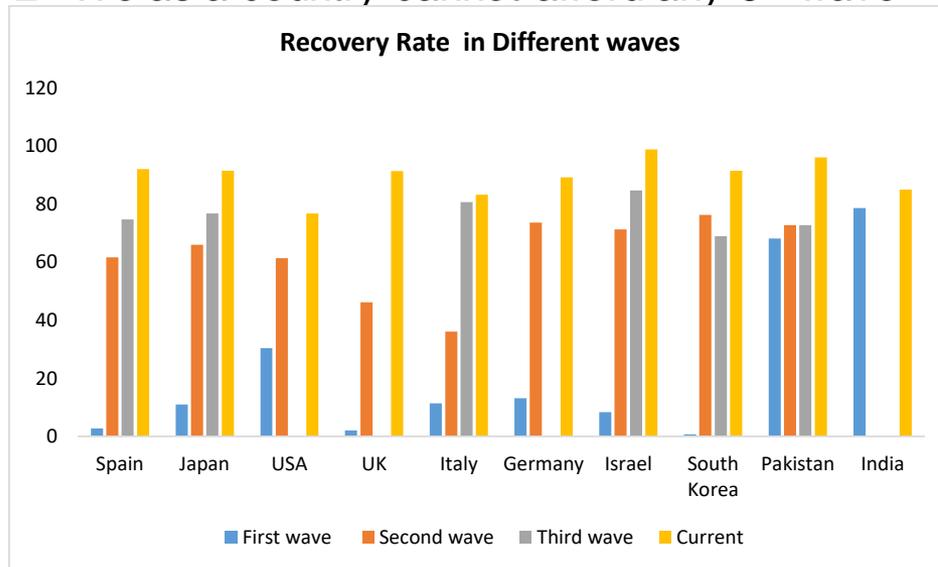
# Stringency and lockdowns not related to infection spread

- Contrary to popular belief in many countries stringency declined post vaccination and cases declined (Israel, Russia, Spain, Serbia)



# Indian Recovery Rate is faltering

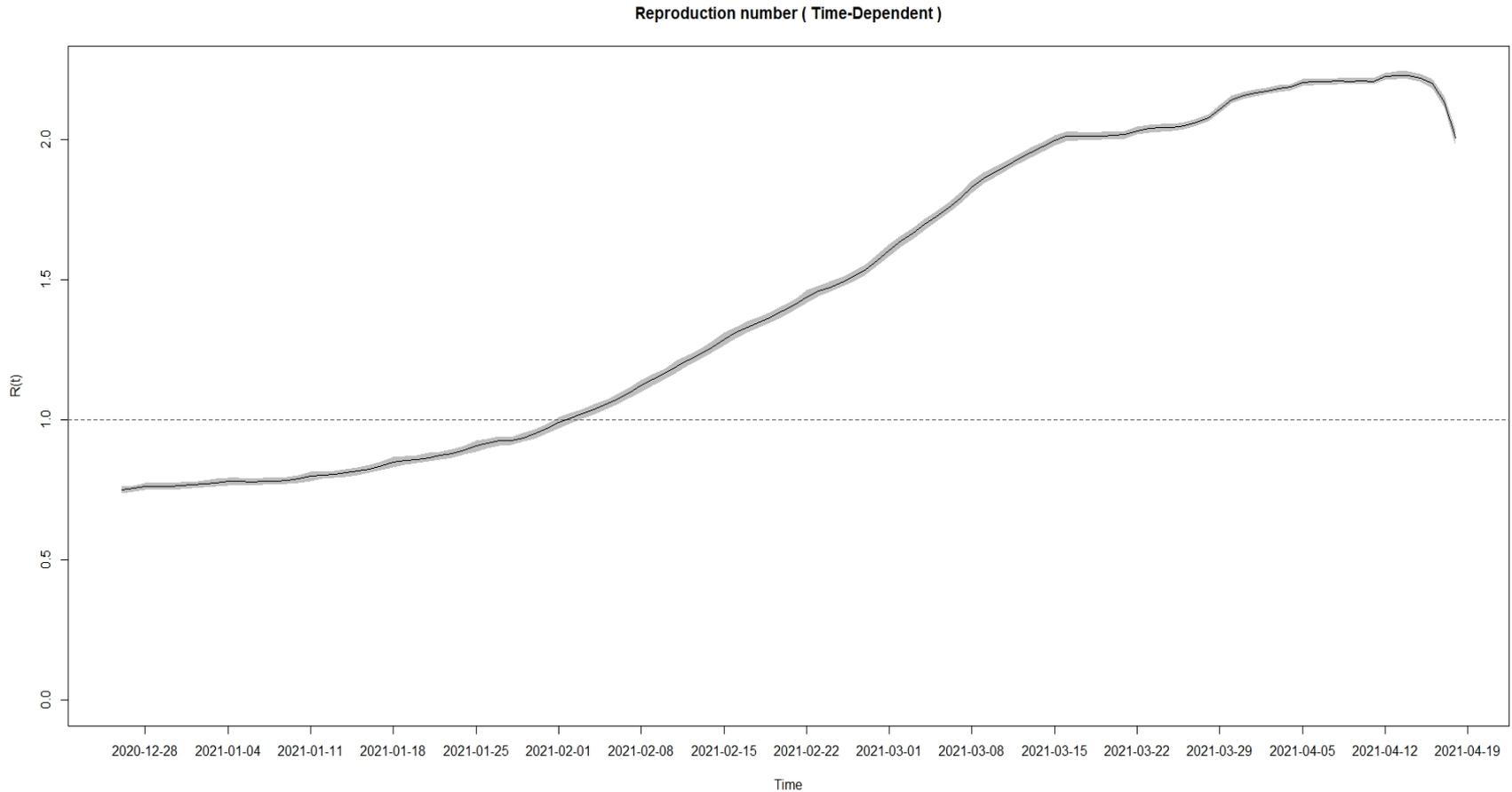
- Recovery rate across countries continues to improve in different peaks
- But in India recovery rate increased to 97.3 till mid-Feb'21 but it has started declining thereafter and moved to 85 recently. Based on our model if we consider second wave peak is reached when recovery rate is around 78%-79%, then active cases would be around 45 lakhs
- Also, the second wave daily peak cases are higher than the first peak daily cases. Further, in 3<sup>rd</sup> wave peak cases are also higher than 2<sup>nd</sup> wave peak cases. It is more severe than 2<sup>nd</sup> wave only in USA and Japan
- We as a country cannot afford any 3<sup>rd</sup> wave



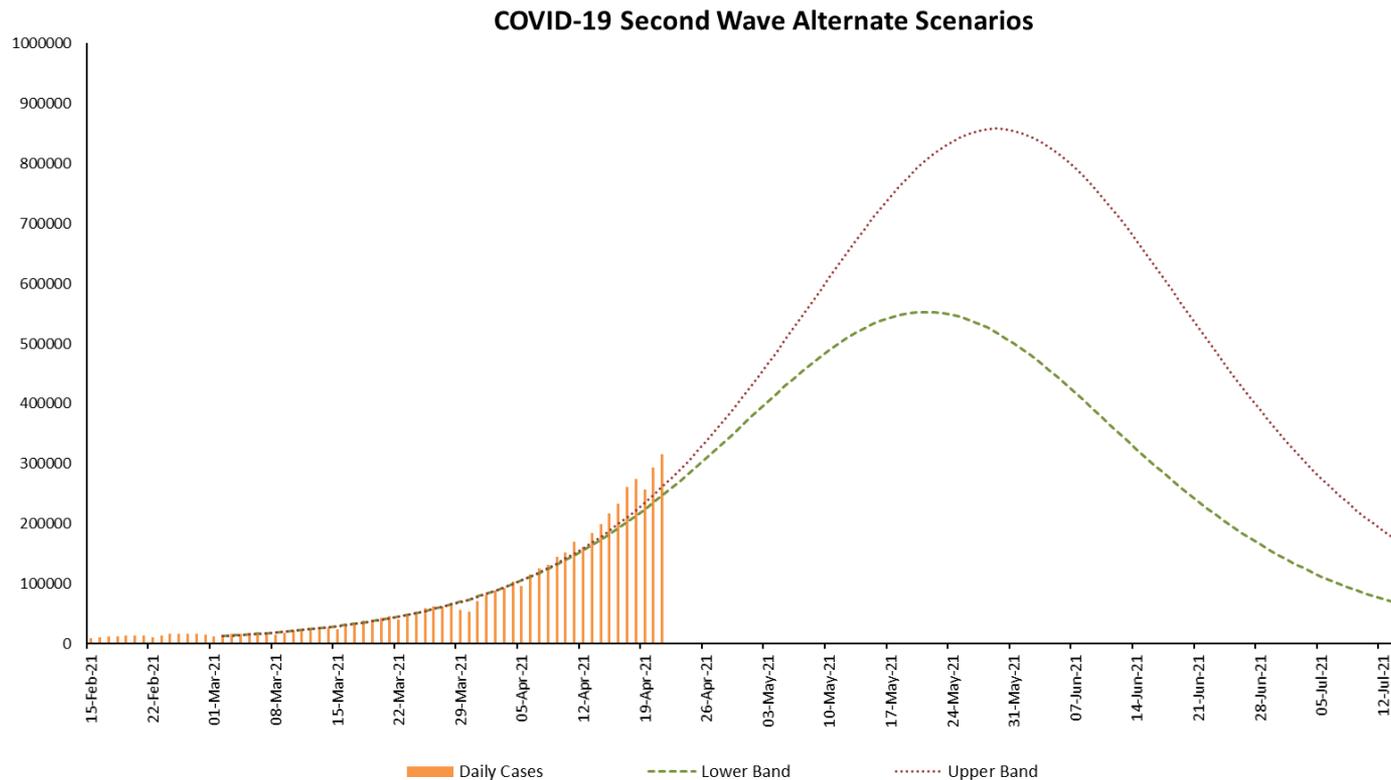
## Days to reach 2nd peak much higher than taken to reach 1<sup>st</sup> peak

- India took maximum days to reach the first peak when compared to other countries. The daily new cases at peak was also much higher in India
- The number of days to reach 2<sup>nd</sup> peak in different countries was much higher compared to days to reach 1<sup>st</sup> peak

Days taken to reach different Peaks						
Country	No of Days required to reach first Peak from above 100 cases	Peak 1 Daily cases	No of Days required to reach Peak 2 from Peak 1	Peak 2 Daily cases	No of Days required to reach Peak 3 from Peak 2	Peak 3 Daily cases
France	27	7578	220	88790	150	57799
Spain	22	10401	221	22766	80	34232
Japan	28	743	114	1998	159	7855
USA	47	38509	95	79543	163	307581
UK	30	7860	216	33409	57	67928
Italy	27	6554	237	41195	119	26793
Germany	22	6824	265	31555	118	30634
Israel	20	765	174	11316	119	10213
Russia	47	11656	166	29258	-	-
Brazil	127	67860	244	97586	-	-
India	187	96793	-	-	-	-



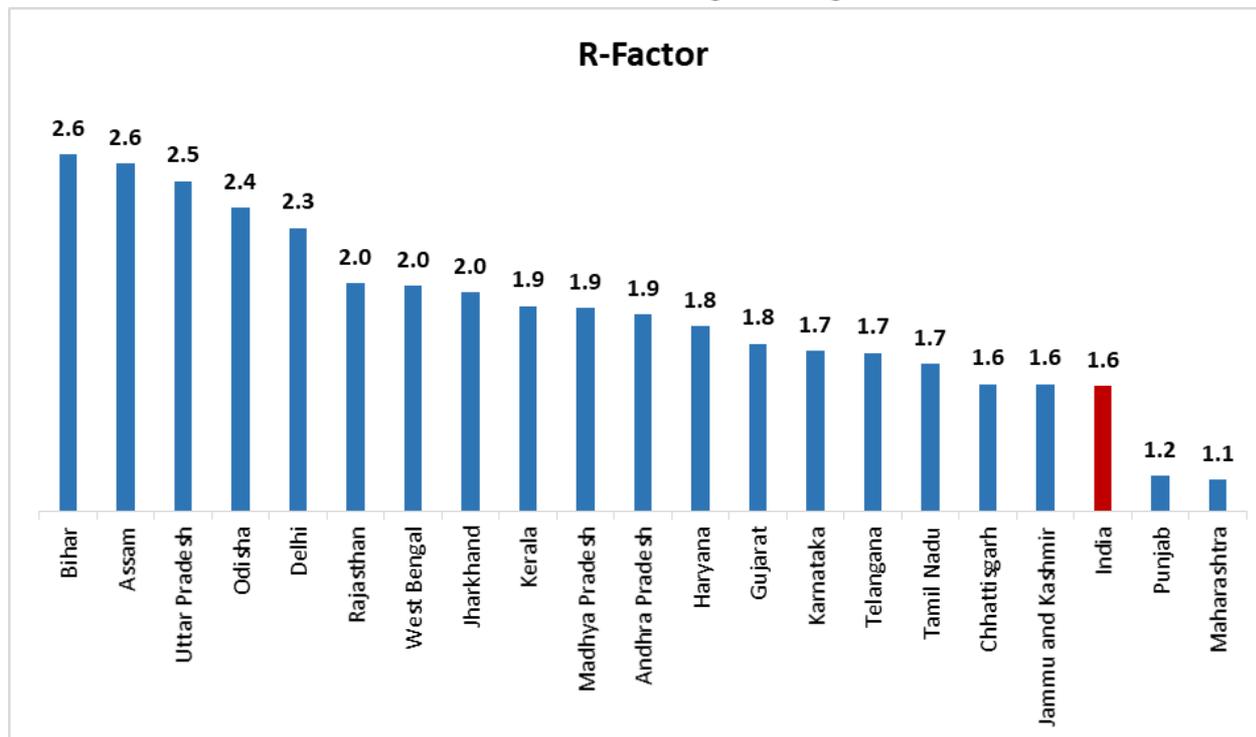
Pan-India 2<sup>nd</sup> Wave began around from Feb, and time dependent R0 is more than 2.0



- High uncertainty in estimating final size on account of spatial/temporal variability, different starting points of second wave and virus attack rate across states
- Our model suggests that the estimated peak time is 96 days from 15-Feb, indicating the peak happening in the 3<sup>rd</sup> week of May?

## State-wise R-Factor shows surprisingly Maharashtra at lowest: Higher base could be the reason, but will lockdown also help?

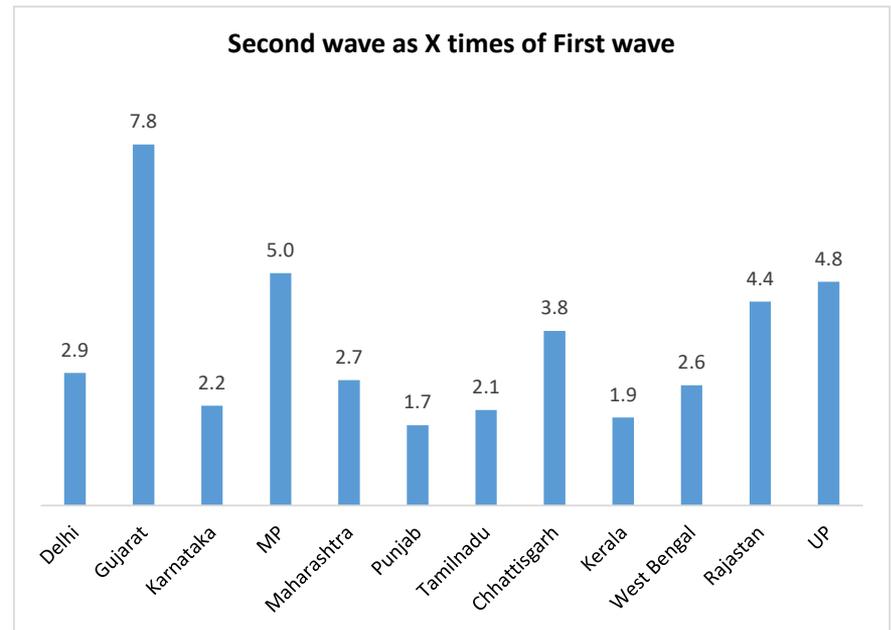
- R-naught ( $R_0$ ), also called the R-factor, stands for the ability of one infected person passing on the disease, on average, to the number of healthy people
- The situation is precarious for the states like Assam, Bihar and UP where  $R_0$  is more than or equal to 2.5
- All India **current average  $R_0$  value is 1.6**;  $R_0$  at the beginning of Lockdown in India was 1.83 between March 27 and April 6. It came down to 1.55 on April 11. However, between April 13 and May 10 it further came down to 1.23 following stringent Lockdown measures



# Maharashtra seems closer to its peak, but other states have to control the spread to achieve national peak!

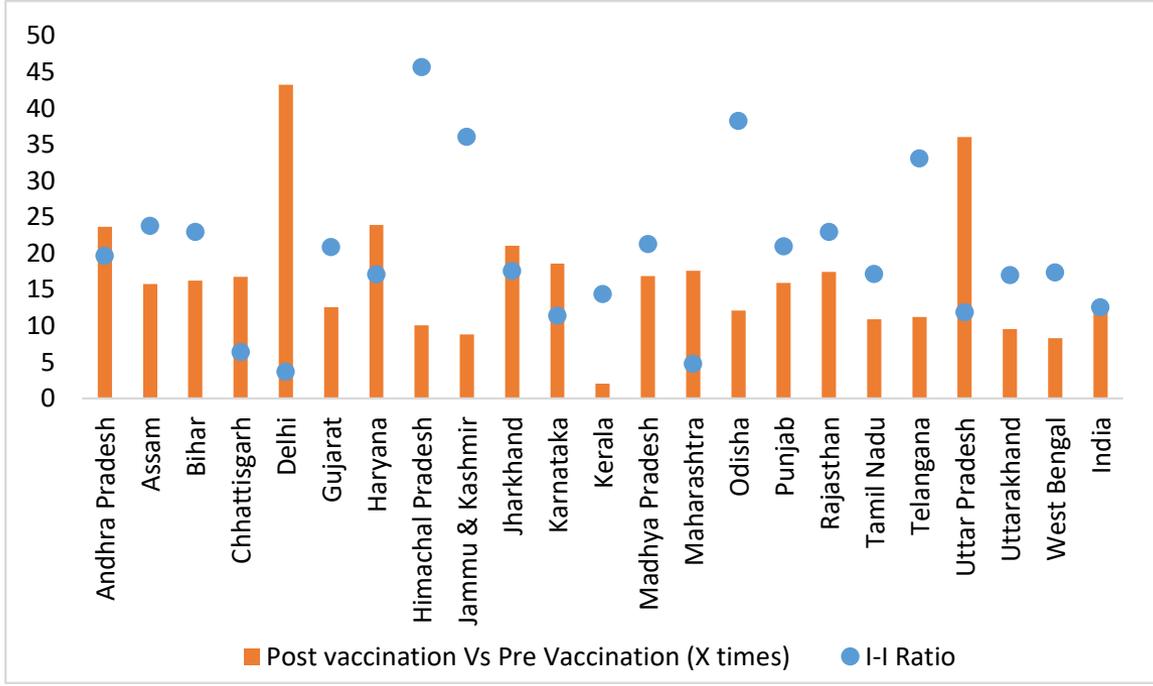
- UP and Maharashtra had achieved peak before national peak in first wave
- Now new cases in Maharashtra seems to be stabilising but share of cases in total of various other states (Chhattisgarh, MP, Gujarat) has increased in the current second wave and these are showing significant increase in daily new cases. So if other states also implement strict actions and control the spread, then national peak may come within 1-2 weeks after Maharashtra peak
- Our earlier projection of a peak in second fortnight of April may now be pushed back into beyond mid –May as vaccination speed has lost its momentum

National Peak and States Peak				
States	First Peak date	Gap from National Peak(- indicates before national peak)	Peak 1 daily new cases	New cases as on 21.04.2021
Delhi	11-11-2020	56	8593	24638
Gujarat	27-11-2020	72	1607	12553
Karnataka	09-10-2020	23	10913	23558
MP	19-09-2020	3	2607	13107
Maharashtra	11-09-2020	-5	24886	67468
Punjab	17-09-2020	1	2848	4953
Tamilnadu	16-09-2020	0	5652	11681
Chhattisgarh	18-09-2020	2	3842	14519
Kerala	10-10-2020	24	11755	22414
West Bengal	24-10-2020	38	4148	10784
Rajasthan	24-11-2020	69	3314	14622
UP	15-09-2020	-1	6841	33106



# Daily new cases rising at higher rate in Delhi, Chhattisgarh, Maharashtra, UP but at the same time injection to infection ratio is also lower

- 7-days moving average (MA) of post-vaccination cases are much higher than 7 Days MA of pre-vaccination cases in certain States (Delhi, Chhattisgarh, Maharashtra, UP, AP) and their 7-days average of injection to infection ratio is also lower



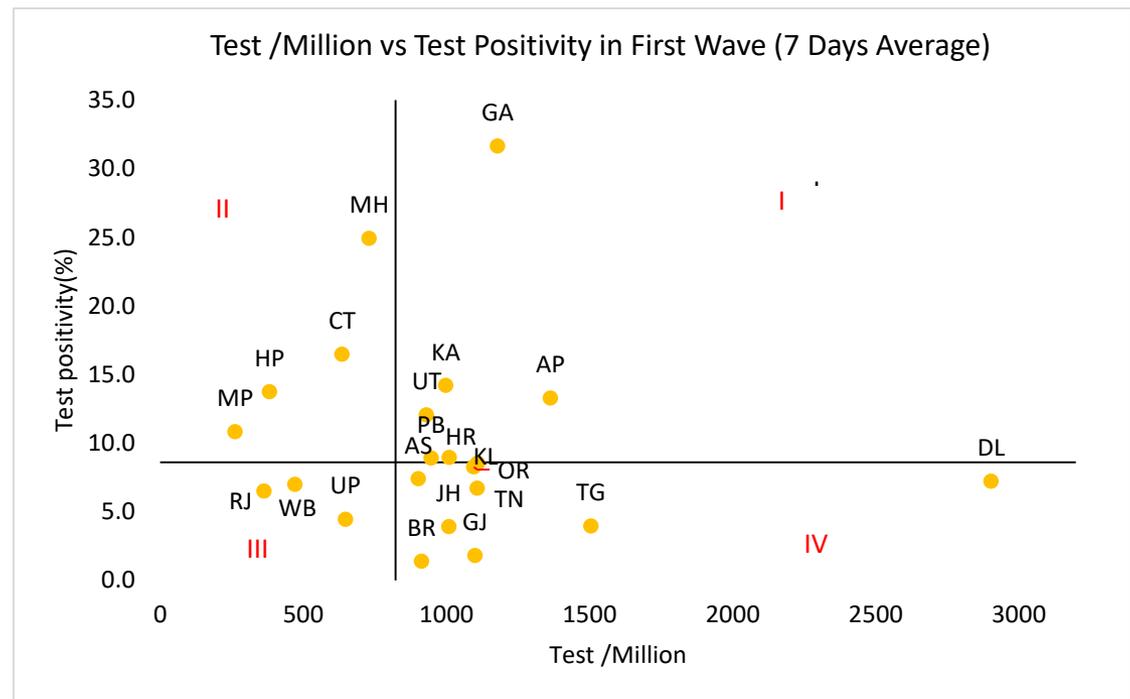
## Fatality rate in Chhattisgarh, HP, Uttarakhand and Odisha higher in current 2<sup>nd</sup> wave than in 1<sup>st</sup> wave

- 7-days moving average (MA) of fatality rate in the current second wave is higher than fatality rate at the time of first wave peak in case of Chhattisgarh, HP, Uttarakhand and Odisha
- All India fatality rate is now around 1.2 and is much lower than fatality rate of 1.6 at the time of first wave peak

State wise Cumulative Fatality Rate %(7 Days MA)		
States	1st Peak Fatality Rate	Current Fatality Rate
Punjab	3.0	2.6
West Bengal	1.9	1.6
Maharashtra	2.8	1.6
Himachal Pradesh	0.8	1.5
Uttarakhand	1.3	1.5
Delhi	2.2	1.4
Gujarat	2.8	1.3
Tamilnadu	1.7	1.3
India	1.6	1.2
Uttar Pradesh	1.4	1.2
Karnataka	1.6	1.2
Madhya Pradesh	2.0	1.1
Chhattisgarh	0.9	1.1
Haryana	1.0	1.0
Jharkhand	0.9	0.9
Andhra Pradesh	0.9	0.8
Rajasthan	1.2	0.8
Bihar	0.5	0.5
Odisha	0.4	0.5
Telangana	0.6	0.5
Kerala	0.4	0.4

# During 1<sup>st</sup> wave peak, maximum states had high tests/million and higher test positivity

- During the first wave around the national peak, a number of states were in quadrant I where number of tests as well as test/million were both high
- Interestingly, states that were testing less even as more infections like Maharashtra, Chhattisgarh, and Madhya Pradesh are now witnessing a larger wave of infections



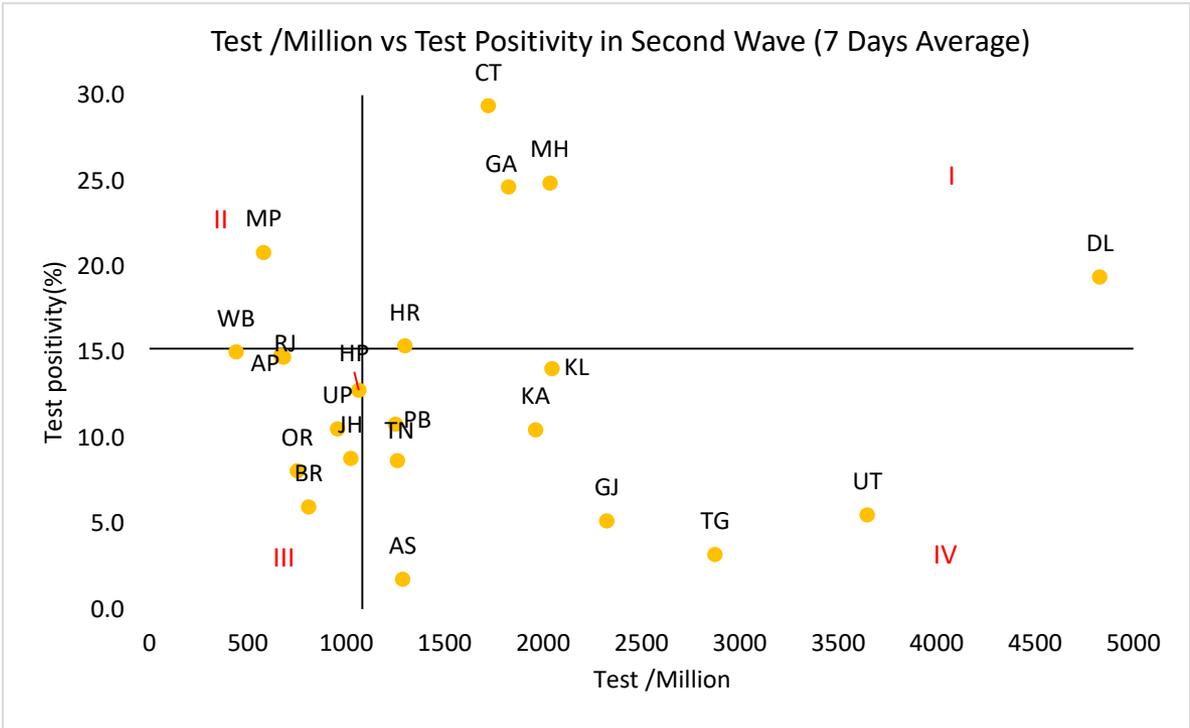
Andhra Pradesh	AP
Assam	AS
Bihar	BR
Chhattisgarh	CT
Delhi	DL
Goa	GA
Gujarat	GJ
Haryana	HR
Himachal Pradesh	HP
Jharkhand	JH
Karnataka	KA
Kerala	KL
Madhya Pradesh	MP
Maharashtra	MH
Odisha	OR
Punjab	PB
Rajasthan	RJ
Tamil Nadu	TN
Telangana	TG
Uttar Pradesh	UP
Uttarakhand	UT
West Bengal	WB

Quadrant 1: High number of tests, High Test Positivity %  
 Quadrant II: Low number of tests, High Test Positivity %  
 Quadrant III: Low number of tests, Low Test Positivity %  
 Quadrant IV: High number of tests, Low Test Positivity %

# In current wave, High number of tests & High test positivity in Maharashtra, Goa, Chhattisgarh, Delhi, Haryana



- ❑ In the current second wave the number of states in 1st quadrant have reduced. Maharashtra, Goa, Chhattisgarh, Delhi, Haryana now belong to this category
- ❑ Larger number of states in III quadrant now (Uttar Pradesh, Odisha, Bihar, Jharkhand, Andhra Pradesh) where low test/million is accompanied by lower test positivity
- ❑ States like West Bengal and Madhya Pradesh have high infections, but are testing not adequately

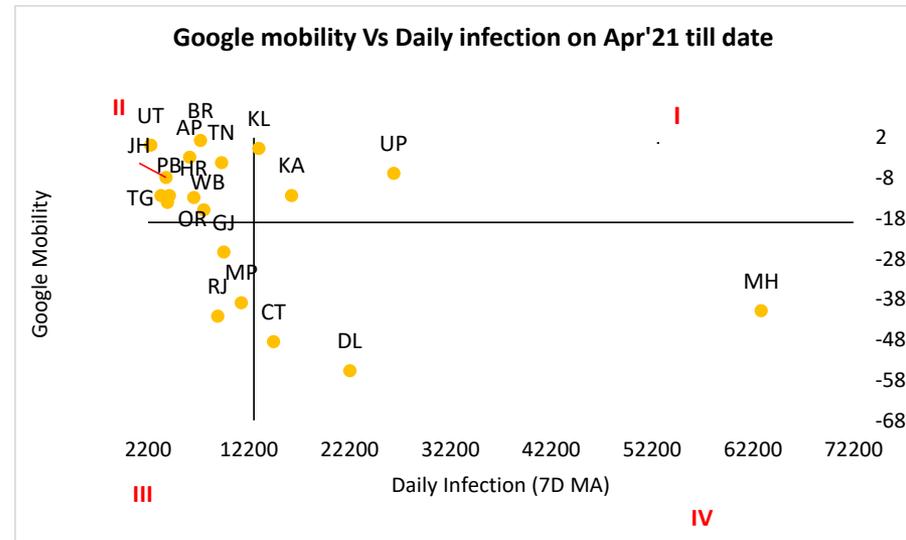
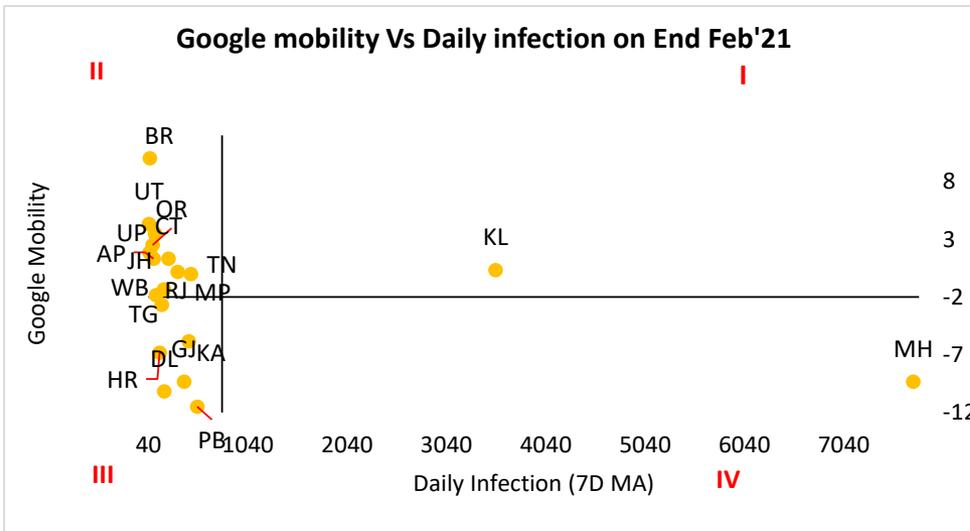


Andhra Pradesh	AP
Assam	AS
Bihar	BR
Chhattisgarh	CT
Delhi	DL
Goa	GA
Gujarat	GJ
Haryana	HR
Himachal Pradesh	HP
Jharkhand	JH
Karnataka	KA
Kerala	KL
Madhya Pradesh	MP
Maharashtra	MH
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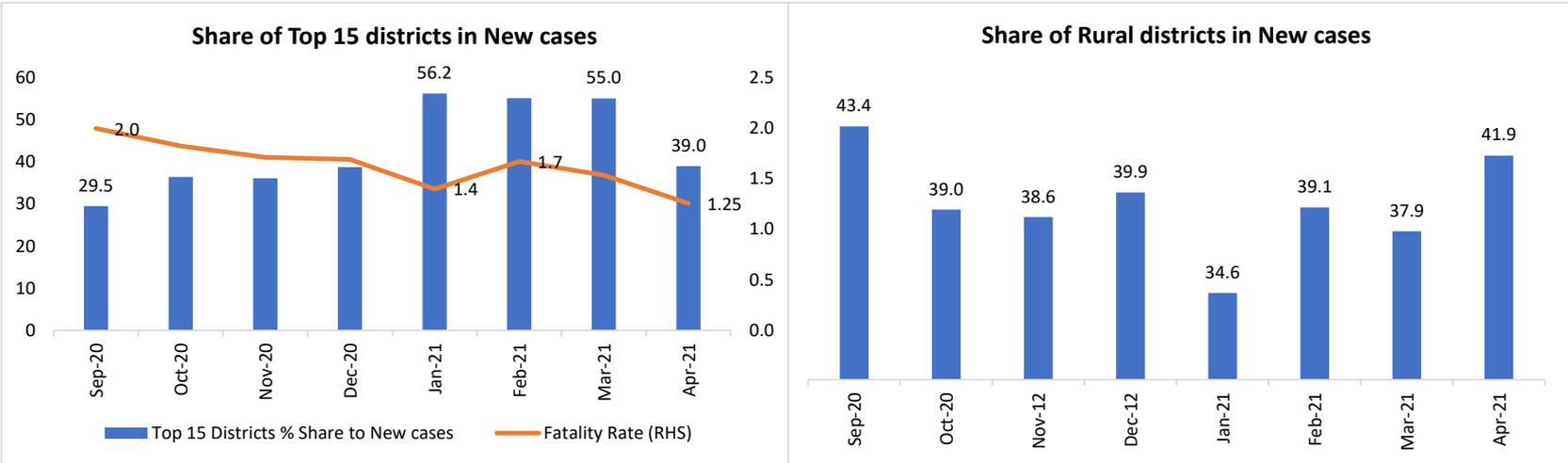
# Mobility & Cases both increased in UP & Karnataka in April, but conversely Mobility & Cases are inversely related in Chhattisgarh, Delhi and Maharashtra

- ❑ In Feb'21, only Kerala was associated with high infection and high mobility, however, in April, UP and Karnataka are witnessing similar trends
- ❑ Quadrant IV which is associated with high infection and low mobility has new entrants, Delhi and Chhattisgarh while in Feb'21 only Maharashtra was there
- ❑ Many states are still in quadrant II where high mobility and low infection are coexistent



- Quadrant I: High infection, High mobility
- Quadrant II: Less infection, High mobility
- Quadrant III: Less infection, Less mobility
- Quadrant IV: High infection, Less mobility

- ❑ New cases in top 15 districts, which are mostly urban has declined in April so far
- ❑ Fatality rate in top 15 districts has also dropped after rising in Feb'21
- ❑ However, the share of rural districts in new cases has risen again in April indicating the spread of infection to rural areas has already occurred



- Amongst the top 15 districts worst affected (mostly urban and only 2 Ahmednagar and Raipur rural), 6 are from Maharashtra. Overall these districts contribute around 25% to the National GDP
- If we look at the rural districts worst affected, 9 are from Maharashtra followed by 3 from Chhattisgarh. These account for around 3.3% of the National GDP
- Also, if we see various districts where congregation was held (Kumbh, Election and farmer protests) recently has seen uptick in daily new cases in April, though still over a low base

Top 15 districts in new cases	
District	State
Delhi	Delhi
Bengaluru Urban	Karnataka
Pune	Maharashtra
Mumbai	Maharashtra
Nagpur	Maharashtra
Thane	Maharashtra
Lucknow	Uttar Pradesh
Nashik	Maharashtra
Ahmedabad	Gujarat
Ahmednagar	Maharashtra
Chennai	Tamil Nadu
Ernakulam	Kerala
Kozhikode	Kerala
Raipur	Chhattisgarh
Surat	Gujarat

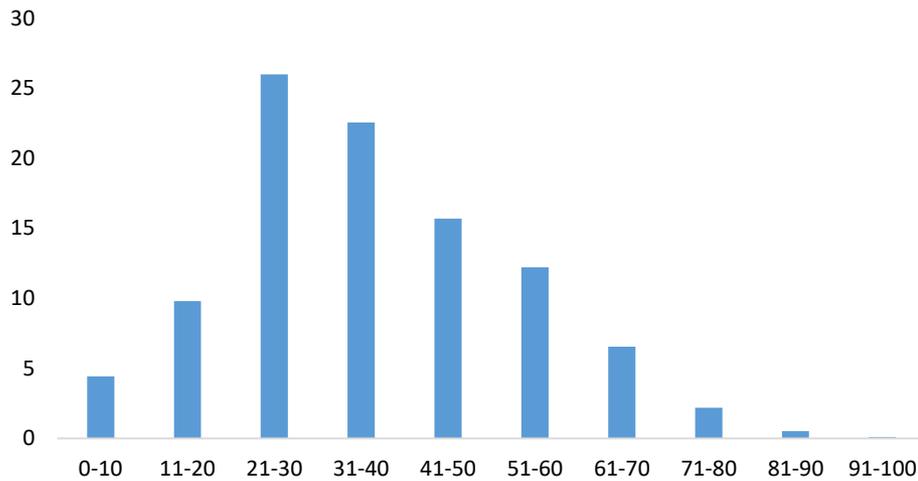
Top 15 rural districts in new cases	
District	State
Ahmednagar	Maharashtra
Raipur	Chhattisgarh
Latur	Maharashtra
Aurangabad	Maharashtra
Chandrapur	Maharashtra
Raigad	Maharashtra
Kottayam	Kerala
Prayagraj	Uttar Pradesh
Jodhpur	Rajasthan
Jalgaon	Maharashtra
Solapur	Maharashtra
Satara	Maharashtra
Durg	Chhattisgarh
Nanded	Maharashtra
Bilaspur	Chhattisgarh

Dsitricts where congregation was held and COVID-19 new cases (month-end)					
Dsitrcits	State	Jan	Feb	Mar	Apr
Haridwar	Uttar Pradesh	12	10	70	572
Jind	Haryana	3	5	98	230
Rohtak	Haryana	4	1	11	145
Sonipat	Haryana	9	4	6	573
Jhajjar	Haryana	3	1	9	117
Ghazipur	Haryana	1	1	6	814
Bhiwani	Haryana	0	1	10	180
Ambala	Haryana	3	21	105	221
Fatehabad	Haryana	1	2	1	126
Muzaffarnagar	Uttar Pradesh	6	0	24	381
Mathura	Uttar Pradesh	0	1	3	355
Birbhum	West Bengal	3	3	30	471
Malda	West Bengal	2	4	12	388
North 24 Parganas	West Bengal	58	47	212	1860

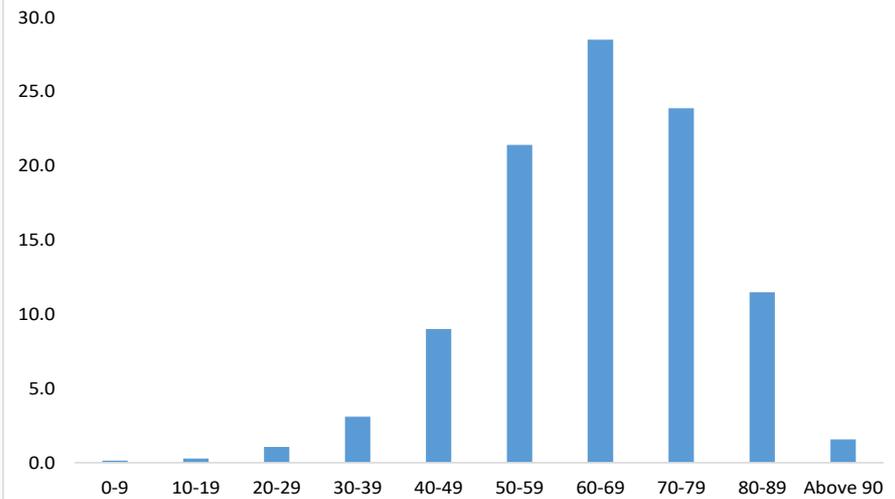
# Age-wise distribution shows maximum cases in 21-30 age group & deaths in 60-69 age group



### Age wise distribution of cases in India



### Age wise covid deaths in Mumbai



- ❑ India's Daily Production Capacity (7287 MT) and Stock (~50,000 MT) comfortably more than Daily Consumption (below 5000 MT)
- ❑ The maximum consumption of medical oxygen in the country is by states of Maharashtra, Gujarat, Madhya Pradesh, Uttar Pradesh, Karnataka, Tamil Nadu, Delhi, followed by Chhattisgarh, Punjab, Rajasthan. While the excess oxygen is available in other Eastern regions like Andhra Pradesh, Jharkhand and Odisha. So, the challenge is logistics (storage and distribution system)
- ❑ To meet the demand & ease of transportation, Government has taken a number of steps like increase production capacity, import of oxygen, PSA plants in hospitals for self sufficiency, utilization of surplus available with steel plants & ramp up transportation through train etc.
- ❑ However, we believe if the cases continue increase and cross 4-5 lakh per day, then undoubtedly, it is difficult, (assuming 10% needs oxygen support)
- ❑ Further to address the transportation issues, we believe all the states should allow ambulance status to the tankers so that they move faster, which will certainly help and reduce the transit time



# Thank you

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**Contact Details:**

Dr. Soumya Kanti Ghosh  
Group Chief Economic Adviser  
State Bank of India, Corporate Centre  
Nariman Point, Mumbai - 400021  
Email: [soumya.ghosh@sbi.co.in](mailto:soumya.ghosh@sbi.co.in)  
[gcea.erd@sbi.co.in](mailto:gcea.erd@sbi.co.in)  
Phone: 022-22742440  
Twitter: [@kantisoumya](https://twitter.com/kantisoumya)