Prevent, Plan and Prepare: Strategies to win against the pandemic

FICCI COVID Task Force

November 2021



FICCI

EY
Building a better working world



“

Hoping for the best, prepared for the worst, and unsurprised by anything in between

Maya Angelou

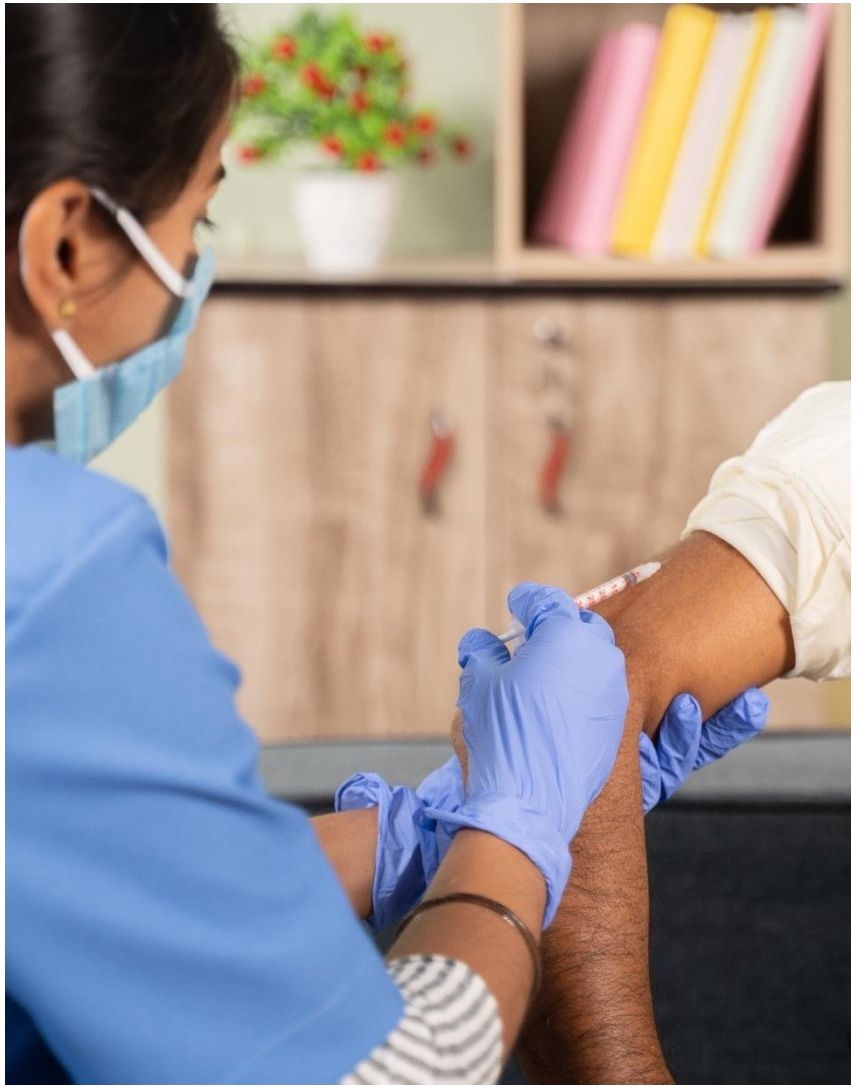
Executive summary (1/2)

- The second wave of the COVID-19 pandemic hit the nation in an unprecedented fashion. The scale and pace with which it rampaged through the country has necessitated future-ready strategic planning to avoid similar catastrophic impacts in case of a third wave.

- However, the erratic nature of the virus makes conclusive predictions on the scale and timing of third wave extremely difficult. Analyzing data from previous waves does not conclusively reveal any homogeneous patterns when studied at a national, state or district level with each region displaying its own distinct wave pattern. Given this variation, a highly localized plan instead of a common nation-wide plan may be critical to designing an effective pandemic response in case of a possible third wave.

- In the extreme event that a third wave emerges with similar intensity as the second wave with a peak of ~4L daily cases, an estimated 9–10L COVID beds may be needed to cater to moderate and severe cases. With the existing infrastructure, demand for ~8L COVID beds can be met, leaving a shortfall of ~2L beds of which 84% is contributed by 6 states and 180–200 districts. However, in the event of a third wave with 50% lower incidence (i.e. ~2L daily cases) and 50% lower hospitalizations, an estimated 3–4L COVID beds would be required and hence 'surge capacity' requirement may be minimal to nil.

- Across the globe, it is observed that ~80% of the cases are mild with symptoms that can be managed with minimal clinical intervention and home isolation. ~15% cases are moderate which require oxygenation and some level of clinical intervention like IV medication, procurement of drugs, etc. ~5% cases are severe requiring critical care. In order to ensure that the right level of care is being provided to patients who need it the most, prioritization and stage gating basis patient acuity becomes critical especially if there is a shortfall in existing medical infrastructure in case of an extreme event.



Executive summary (2/2)

- For management of moderate cases, COVID intermediate care centers (CICC) or a transition care facility could offer a potential low cost and scalable option catering to the 'surge capacity' requirement if a third wave hits the country with similar intensity and peak case load as that in wave 2. These transition care centers could help free up beds and resources in hospitals to be utilized for more severe cases. Seamless and effective management of patients and hospital resources can be enabled by a hub and spoke model wherein these centers are attached to or in proximity to a traditional hospital. In order to better meet the objective of these centers, clinical criteria for admission and transfer (for step-up/step-down care) of patients will need to be pre-defined and adhered to.

- Data from across the globe indicates that vaccination has been seen to reduce hospitalizations and mortality implying reduced burden on hospitals. While there is no empirical evidence to suggest that a third wave will specifically target children, they are among the most vulnerable groups as majority of population under 18 years is presently unvaccinated. While it may be critical to start vaccinating the pediatric population at the earliest, it is also important to focus on ramping up specific medical infrastructure like PICUs (pediatric intensive care unit) and healthcare workers specializing in pediatric treatment to enable COVID care for children.

- While government interventions in building an effective response plan for third wave is imperative, it is crucial that the general public continues to be cautious and does not develop 'COVID fatigue' presuming that the pandemic is over. Since daily case numbers have been consistently low in last few months, people may be susceptible to an 'exponential growth bias' tending to believe that even if there is a third wave, cases will grow only linearly. With the end of year festival season having already commenced, it is important that mobility restrictions and controlled social gatherings are continued to be imposed by governments. An equally important role needs to be played by the general public who must not show apathy to these measures while strictly adhering to safety guidelines including social distancing and wearing masks.



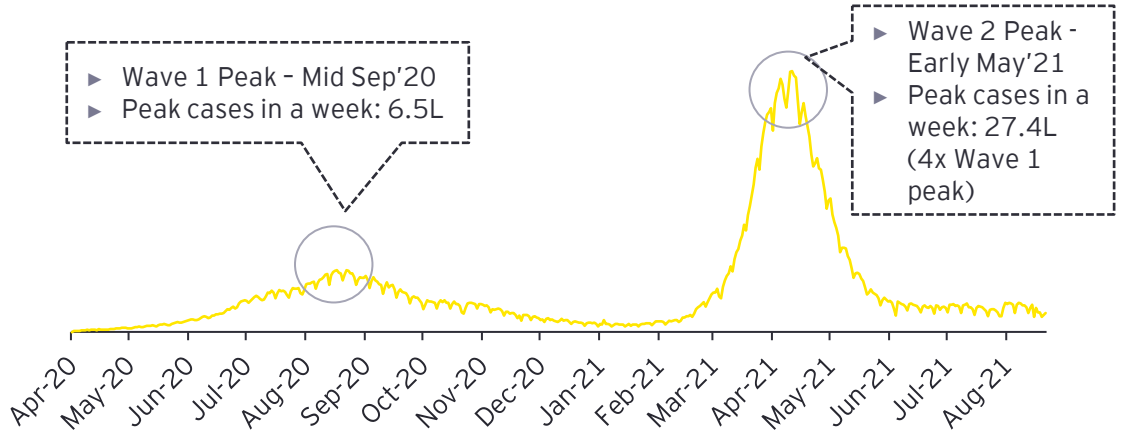
1

Analysis of data from the previous two waves does not conclusively reveal any consistent trends or homogeneous patterns across states or districts, thereby necessitating the need for localized preparedness plans over a common national strategy

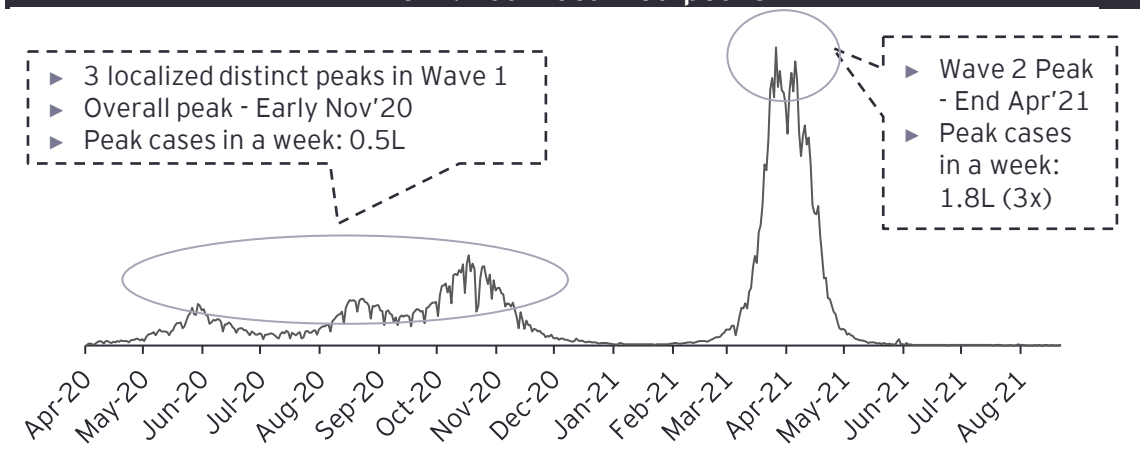


While at a country level we have experienced 2 distinct waves, localized wave patterns are observed when we study the data at a state level

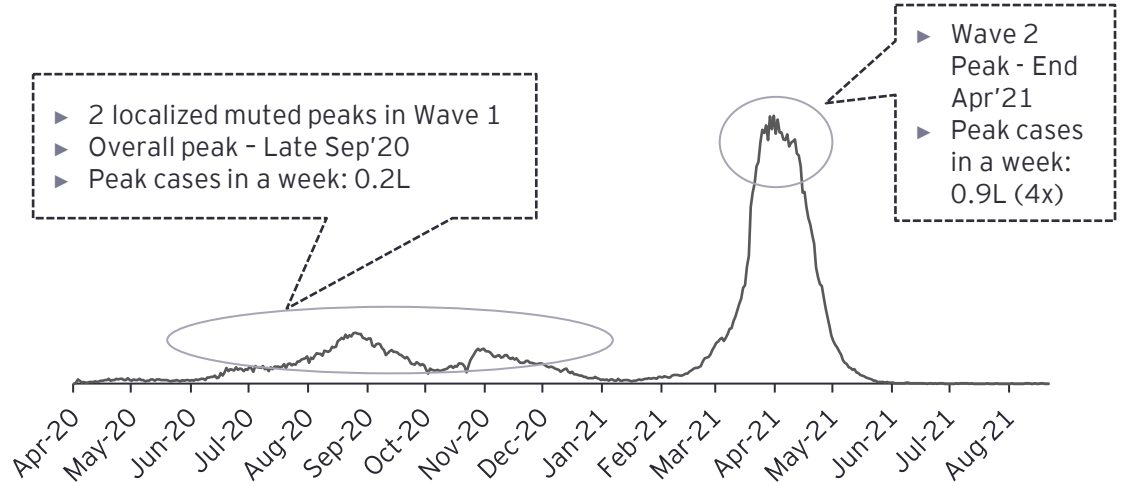
India: Two distinct peaks



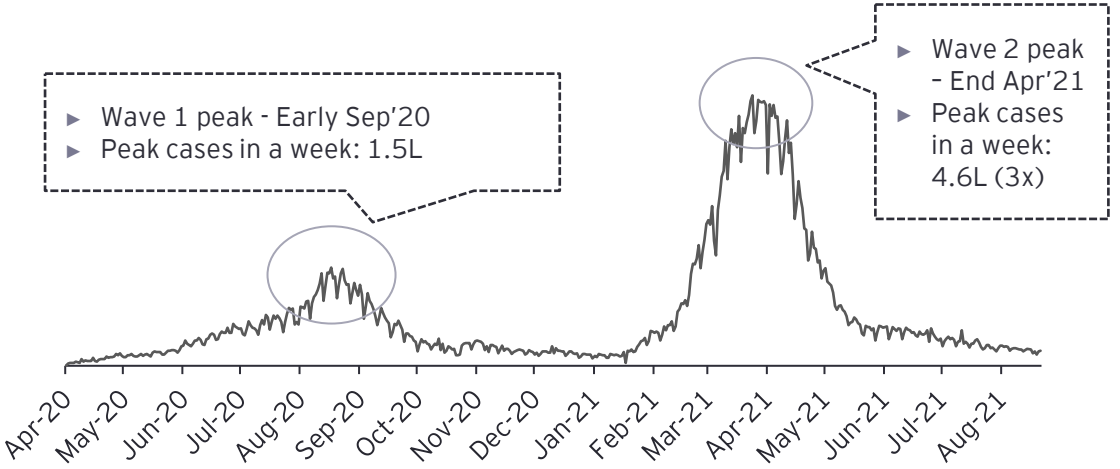
Delhi: Four localized peaks



Madhya Pradesh: Muted first wave with sharp peak in second wave



Maharashtra: Two distinct peaks



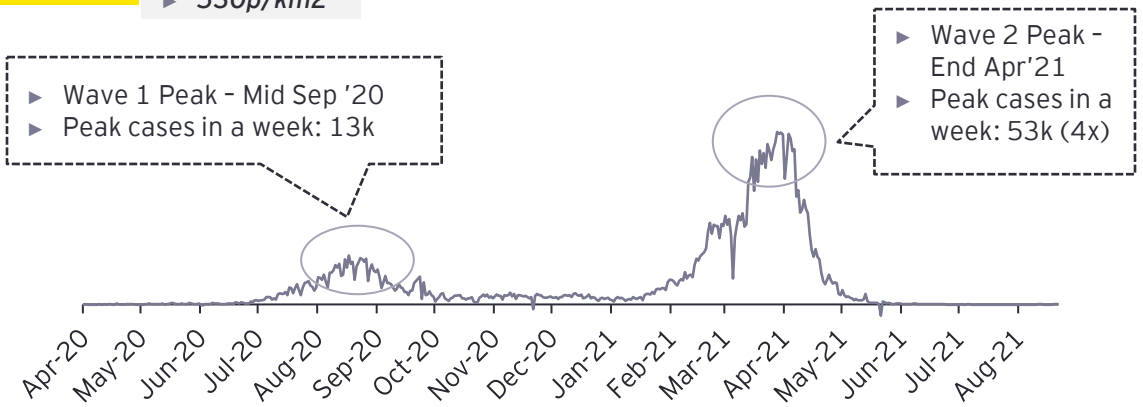
Source: covid19india.org (last accessed 16th Sep 2021)

Even within a given state, comparison of districts with similar levels of urbanization and population density show non-homogeneous wave patterns

Two distinct peaks observed in Nagpur in Sep'20 and Apr'21 while Pune saw three peaks starting as early as Jul'20

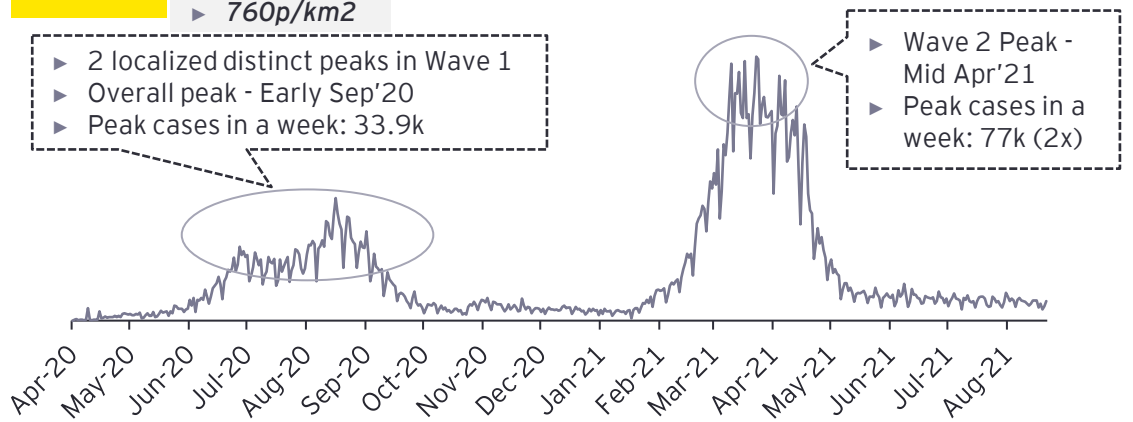
Nagpur

- *68% urban*
- *530p/km2*



Pune

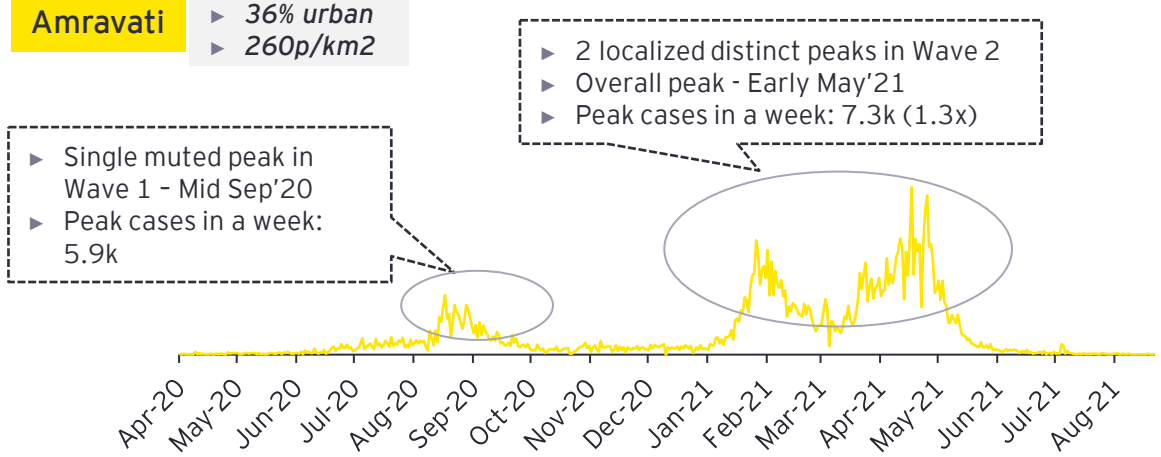
- *61% urban*
- *760p/km2*



Amravati seems to have had three waves with distinct peaks in Sep'20, Feb'21, May'21 while Sangli seems to still be in Wave-2

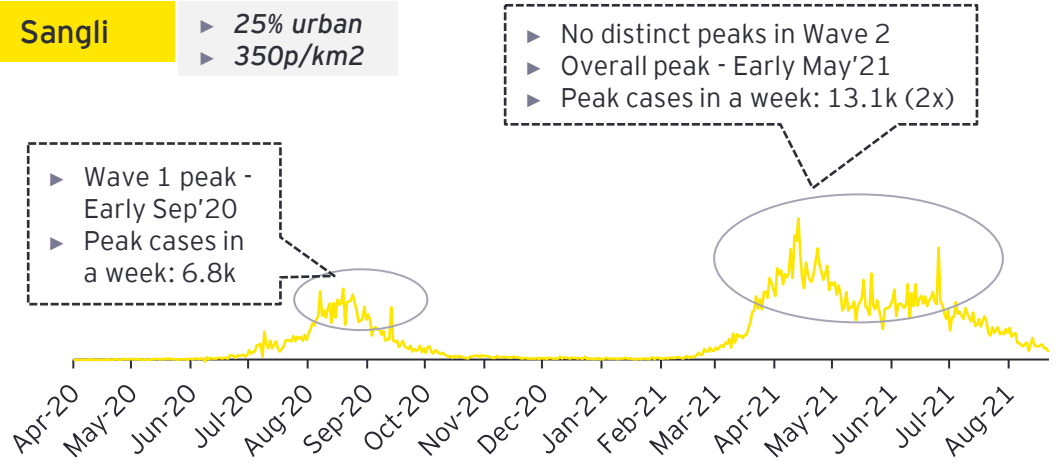
Amravati

- *36% urban*
- *260p/km2*



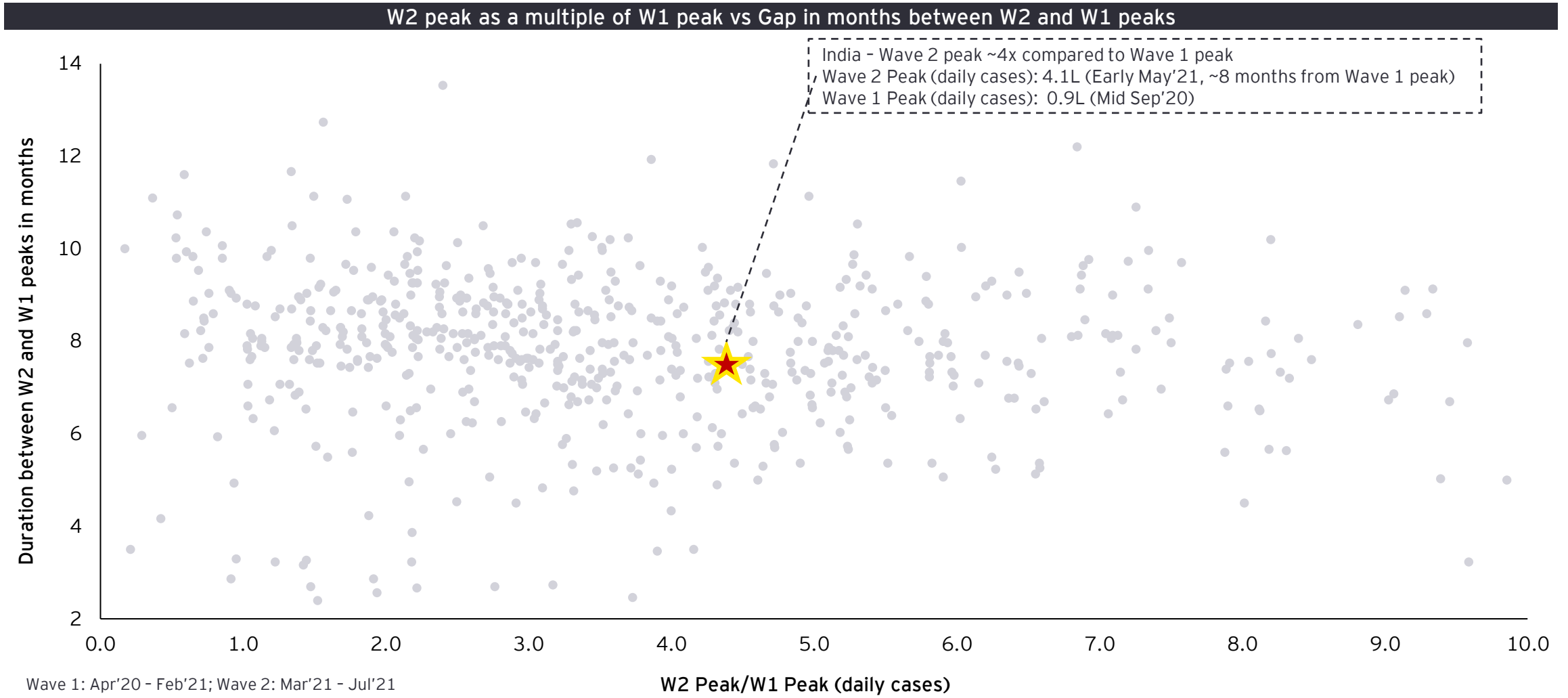
Sangli

- *25% urban*
- *350p/km2*



Source: covid19india.org (last accessed 16th Sep 2021)

Different districts witnessed varying levels of wave 2 intensity vis-à-vis wave 1 and attained peaks at varying timelines

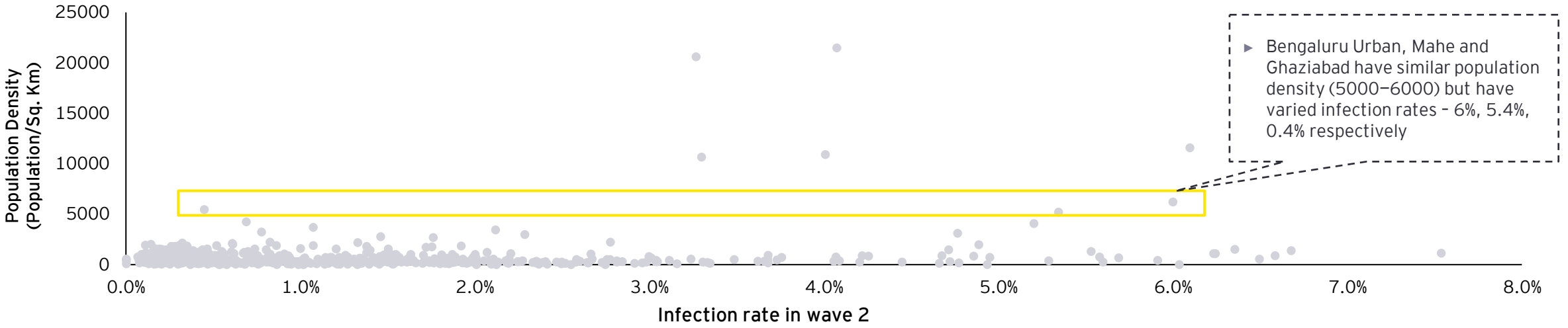


Wave 1: Apr'20 - Feb'21; Wave 2: Mar'21 - Jul'21

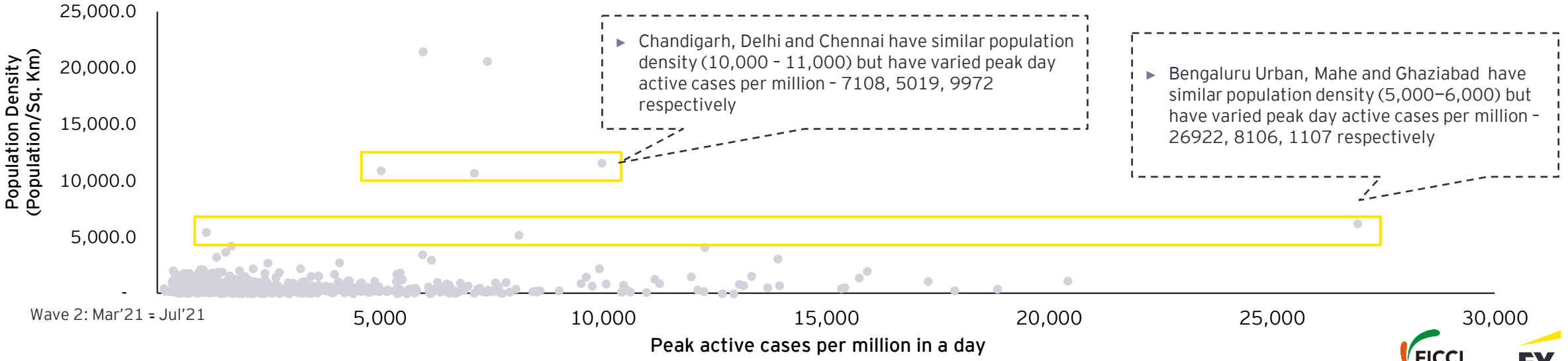
Source: covid19india.org (last accessed 16th Sep 2021)

Districts with similar population density have experienced different infection rates implying no direct correlation

Infection rate by population density (district wise comparison)

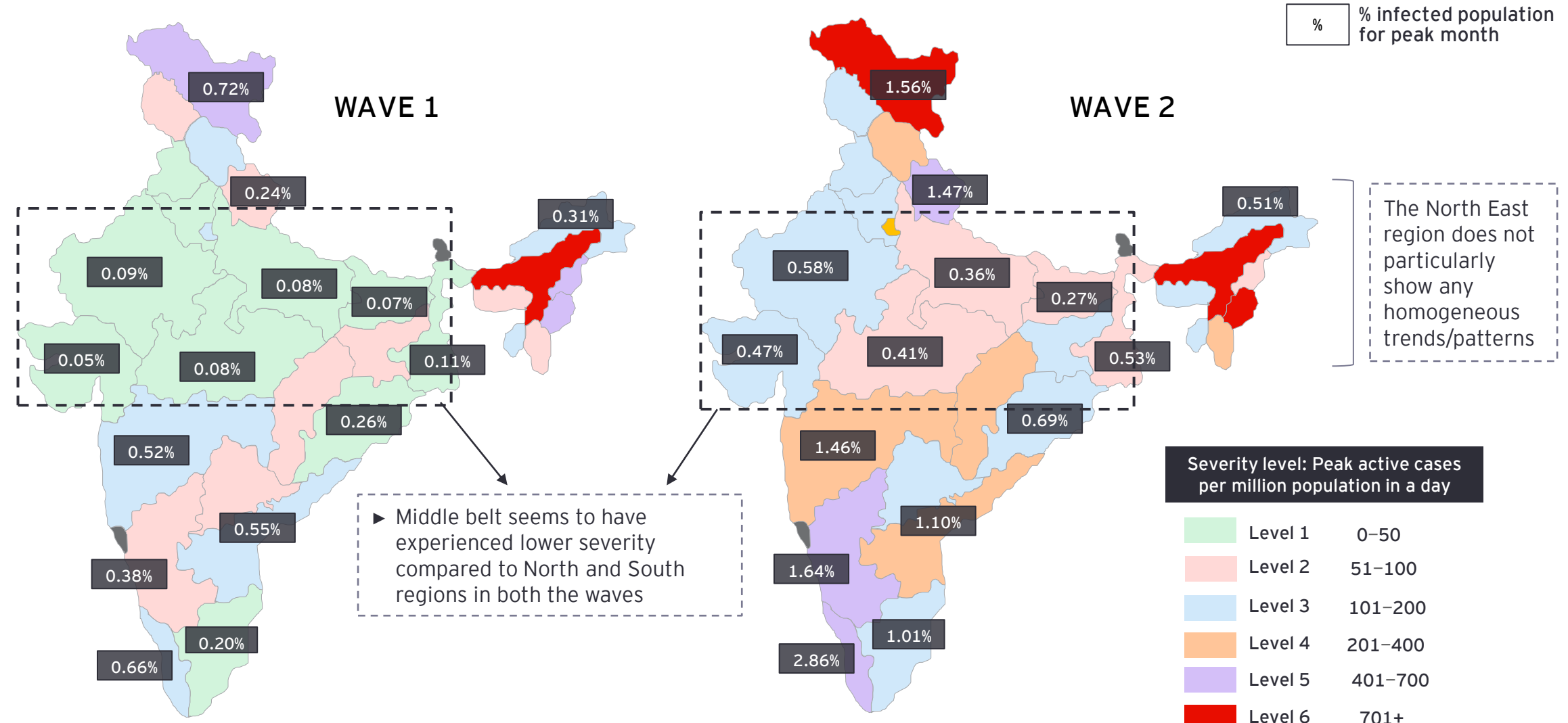


Peak day active cases per million by population density (district wise comparison)



Wave 2: Mar'21 – Jul'21

Comparison of peak active cases by state in wave 1 and wave 2 suggests that middle belt seems to have experienced lower severity compared to North and South regions



Wave 1: Apr'20 – Feb'21; Wave 2: Mar'21 – Jul'21
Source: covid19india.org (last accessed 16th Sep 2021)

However, when we plot state clusters across parameters like testing or urbanization- no conclusive correlations emerge to indicate any specific reasons for these trends

Movement in severity levels (W1 →W2)	States	Population density (p/km^2)	Degree of urbanization (% urban population)	Total tests per million (In millions)	Peak cases per million population in a week (wave 1)	Peak cases per million population in a week (wave 2)	Specific super spreader events/ mass gatherings in the state
Up by 1 level	Uttar Pradesh (L1->L2)	1001	23% ↓	14.06	195	1,032 (5x)	Kumbh Mela - May'21
	Himachal Pradesh (L3->L4)	133	10% ↓	3.95	793	4,413 (6x)	-
	Madhya Pradesh (L1->L2)	270	27% ↓	7.66	203	1055 (5x)	-
Up by 2 levels	Delhi (L3->L5)	10927	97% ↑	1.16	2,585	8,908 (3x)	-
	Kerala (L3->L5)	899	48% ↑	9.03	1,749	7,645 (4x)	Elections - April'21
	Odisha (L1->L3)	295	12% ↓	9.4	655	1788 (3x)	-
	Tamil Nadu (L1->L3)	688	44% ↑	15.36	523	2,712 (5x)	Elections - April'21
	Gujarat (L1->L3)	348	42% ↑	6.58	140	1,286 (9x)	-
Up by 3 levels	Karnataka (L2->L5)	381	41% ↑	15.24	999	4,726 (5x)	-

>500 p/km^2 <500 p/km^2 ↑ >40% urban population ↓ <40% urban population

- Gujarat and Odisha have similar population density and testing rates. However, degree of urbanization is very different
- Similarly UP and MP have low urbanization levels, but population density is very different
- Despite no super-spreader events, states like Himachal, Mizoram, Gujarat witnessed over 5X weekly peak cases in wave 2 compared to wave 1

Source: covid19india.org (last accessed 16th Sep 2021)

2

Learnings from countries currently experiencing third wave indicates greater vulnerability among pediatric population, positive impact of vaccination in reducing hospitalization and also stresses importance of focused mobility restrictions to limit spread of infection

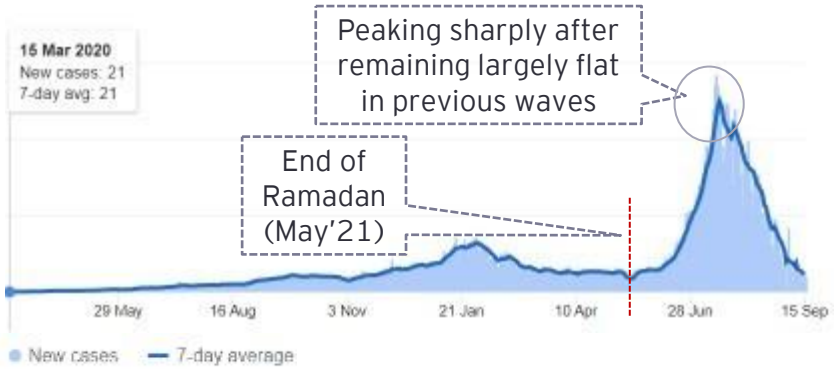


Indonesia: surge in cases post Ramadan with high death rates in children below 5 years being attributed to vulnerabilities from malnutrition and low vaccination coverage

Country/ State

Indonesia

COVID Wave (Daily cases)



Key characteristics of third wave/ reasons being attributed

- **Increased death rates of children below 5 years** owing to vulnerabilities from malnutrition (Child deaths as percentage of total deaths due to COVID is ~1% in Indonesia vs global average of 0.3% *as on 24th Aug 2021*)
- **Low overall vaccination**
- **High social mobility** ignoring social distancing norms post Ramadan

Key takeaways/ implications for India

- Malnutrition in India higher than Indonesia (Global hunger index of 27.2 in India vs 19.1 in Indonesia) → **Need to protect pediatric population**
- Vaccination in India only slightly better than Indonesia (43% population vaccinated with 1 dose vs 28% in Indonesia), Zydus (ZycoV-D) vaccine recently approved for 12–18 age group → **Need to ramp up vaccination**
- Large number of festivals between Aug'21–Nov'21 → **Need for mobility restrictions to control mass gatherings**

% children vaccinated in 2019 (UNICEF data)

Vaccine	Disease type	India	Indonesia	US	UK	Brazil	Vietnam
BCG	Tuberculosis	92	90	-	-	79	96
DTP	Diphtheria-Tetanus-Pertussis	91	85	94	93	70	89
HEPB	Hepatitis B	91	85	91	93	72	89
HIB	Haemophilus influenzae	91	85	91	93	72	89
MCV	Measles	84	71	95	87	54	92
PCV 3	Pneumonia	15	3	92	91	84	
POL 3	Polio	90	85	93	93	85	89
RCV 1	Rubella	95	88	90	91	91	92

When we compare the extent of child immunization across countries, Indonesia seems to fare poorly compared to other nations

However, direct correlation of immunization programs with high death rates of children in COVID third wave cannot be inferred, for e.g.

- US: Higher vaccination coverage but is witnessing a recent surge in pediatric hospitalizations
- Brazil: Low vaccination coverage but no major reports of high infection or death rates in children so far

COVID Vaccination % as on 15th Sep 2021

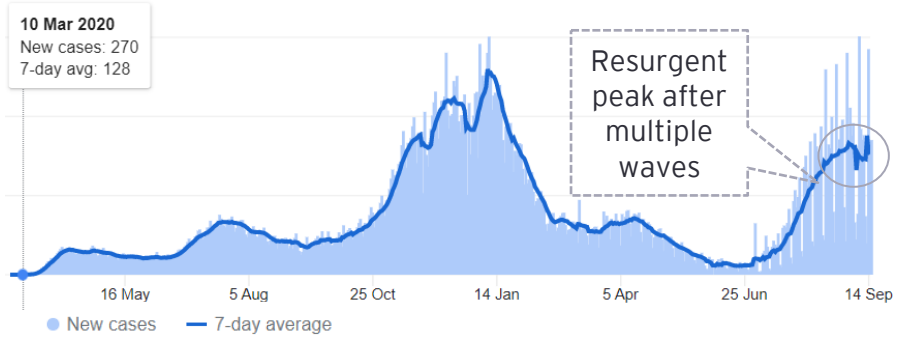
Source: ourworldindata.org, UNICEF, Secondary research (https://the-ken.com/bfo/keeping-an-eye-on-the-kids/ - published 27th Jul 2021)

US: resurgence in cases with some states reporting high pediatric hospitalizations, most suffering from PIMS which is a rare complication of COVID linked to obesity

Country/ State

US

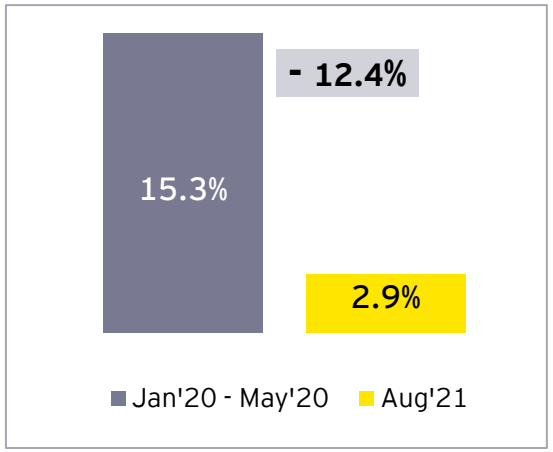
COVID Wave (Daily cases)



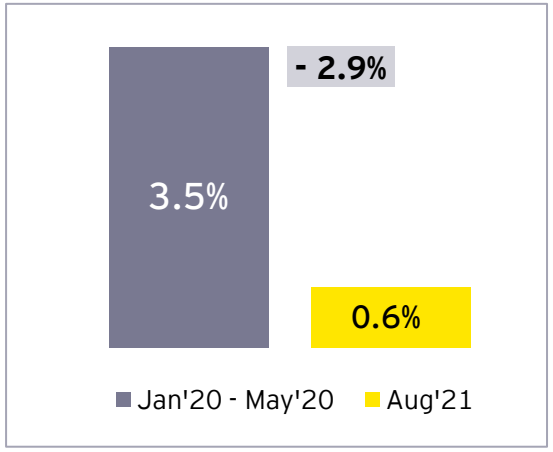
Key characteristics of third wave/ reasons being attributed

- **~96% weekly jump seen in child hospitalizations in Aug 1st week driven by states like Alabama, Arkansas, Louisiana**
- Most of the recent hospitalized cases were found to be suffering from pediatric inflammatory multisystem syndrome (PIMS), a rare complication of COVID that affects only children
  - Obesity and high blood sugar levels are risk factors for PIMS (in the US, ~21% of children are obese)

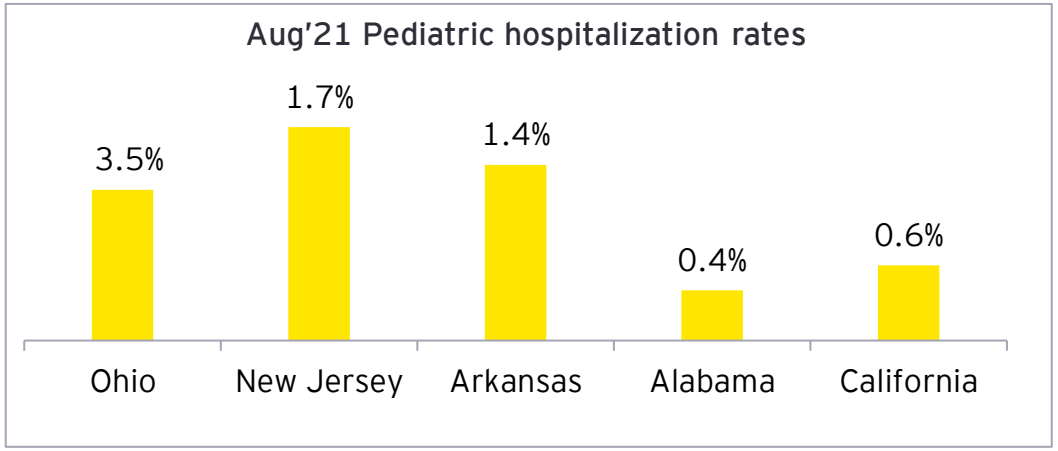
US Hospitalization rate – Overall



US Hospitalization rate – Pediatric



While overall hospitalization rate (including pediatric) has decreased in Aug'21 compared to Jan'20–May'20 period, state specific variations seen in pediatric hospitalization rates



Source: ourworldindata.org, CDC COVID19 Surveillance Dashboard, American Academy of Pediatrics report 5th Aug 2021; Pediatric: 0–17 years age

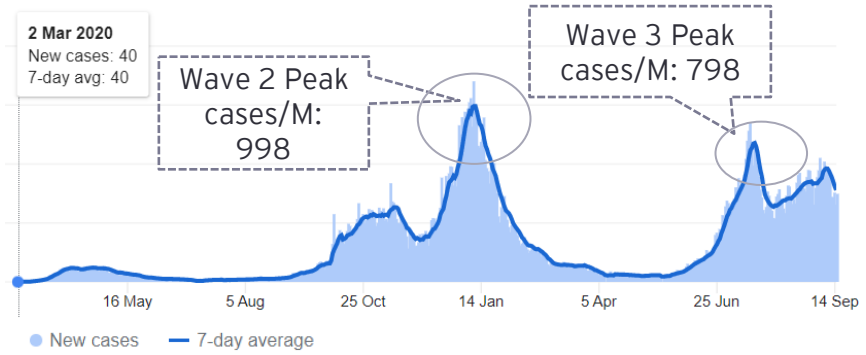
Note: Hospitalization rate = No. of overall (or pediatric) hospitalizations/ No. of overall (or pediatric) cases; For Dec'20 to Mar'21, US overall hospitalization: 3.6%, pediatric hospitalization: 0.6%

Setting up pediatric task force and expanding pediatric infrastructure seem to be the key steps being undertaken by states to prepare for third wave

States	Step taken
Maharashtra	▶ Special pediatric task force set up for COVID preparedness ▶ Measures underway to build facilities with pediatric beds (**1,500** pediatric beds set up in Mumbai, most of them with oxygen)
Delhi	▶ Like Maharashtra, Delhi to set-up special pediatric task force for COVID preparedness ▶ Measures underway to expand/modify facilities to be more child-friendly
Karnataka	▶ Like Maharashtra, Karnataka to set-up special pediatric task force for COVID preparedness
Tamil Nadu	▶ Started working on infrastructure in pediatric wards ▶ Sensitizing pediatricians to COVID-19 treatment protocols and management
Gujarat	▶ Ramping up infrastructure to handle pediatric cases (**15,000** pediatric oxygen beds set up in state)

Source: https://www.reuters.com/world/india/indian-states-preparing-next-covid-wave-focus-children-2021-08-19/; https://www.thehindu.com/news/national/tamil-nadu/readying-for-a-third-wave-tamil-nadu-ramps-up-infrastructure-in-pediatric-wards/article34862019.ece; https://nidm.gov.in/PDF/pubs/TWPCVR_2021.pdf

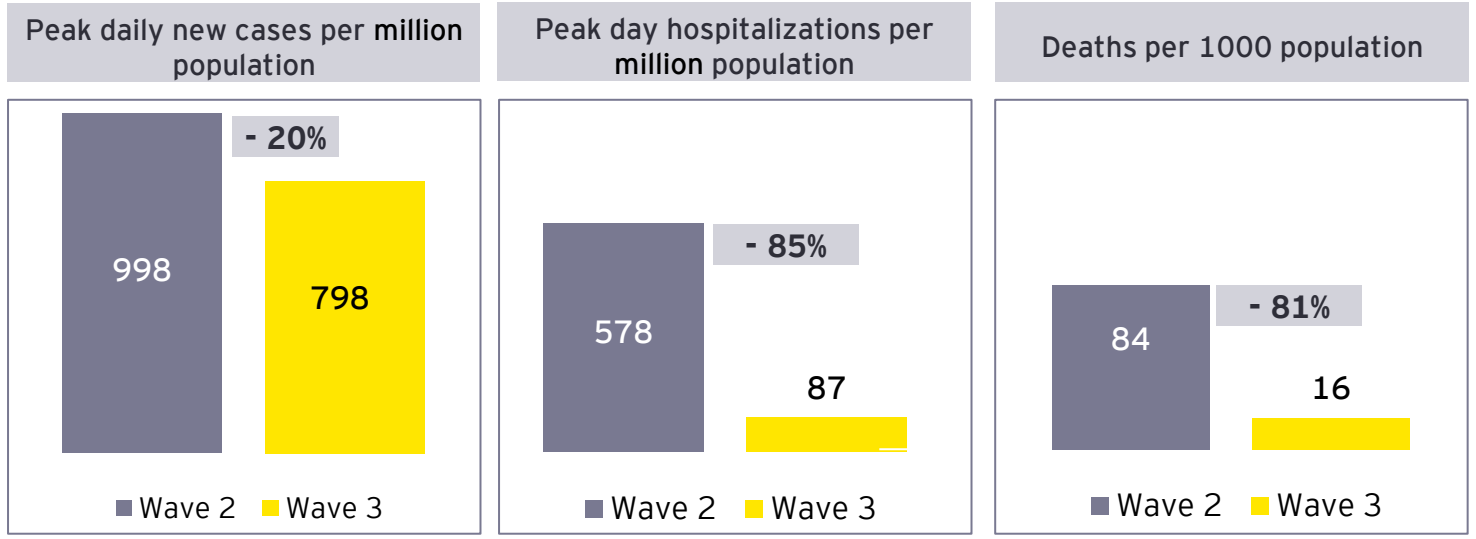
UK: reduced hospitalizations and death rates seen in wave 3 compared to wave 2 attributed to high vaccination coverage

Country/ State	COVID Wave (Daily cases)	Key characteristics of third wave/ reasons being attributed
UK		► Despite surge of cases in third wave, hospitalization rates and death rates are significantly lower than second wave ► Higher vaccination % attributed to lower deaths (~73% population vaccinated with 1 dose)

Key takeaways/ implications for India

► ~43% population vaccinated in India with 1 dose v/s ~73% in the UK → **Need to ramp up vaccination**

UK- Wave 2 period: Sep'20 to Apr'21; Wave 3: May'21 till present



Source: ourworldindata.org, UK Coronavirus Website, Secondary Research

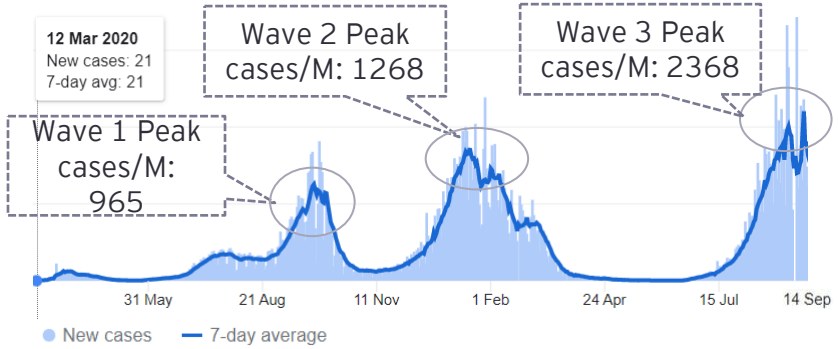
Reduced hospitalizations and death rates in wave 3 vis-à-vis wave 2 due to high vaccination coverage

► Peak cases/million in wave 3 dropped only 20% vis-à-vis wave 2 but hospitalized patients/million has dropped by 85%

► Death rates have dropped by 81% from 84 per 1000 in wave 2 to 16 per 1000 in wave 3

COVID Vaccination % as on 15th Sep 2021

Israel: increasing daily cases and hospitalizations in wave 3 compared to previous waves attributed to waning immunity from vaccine and early relaxations in restrictions

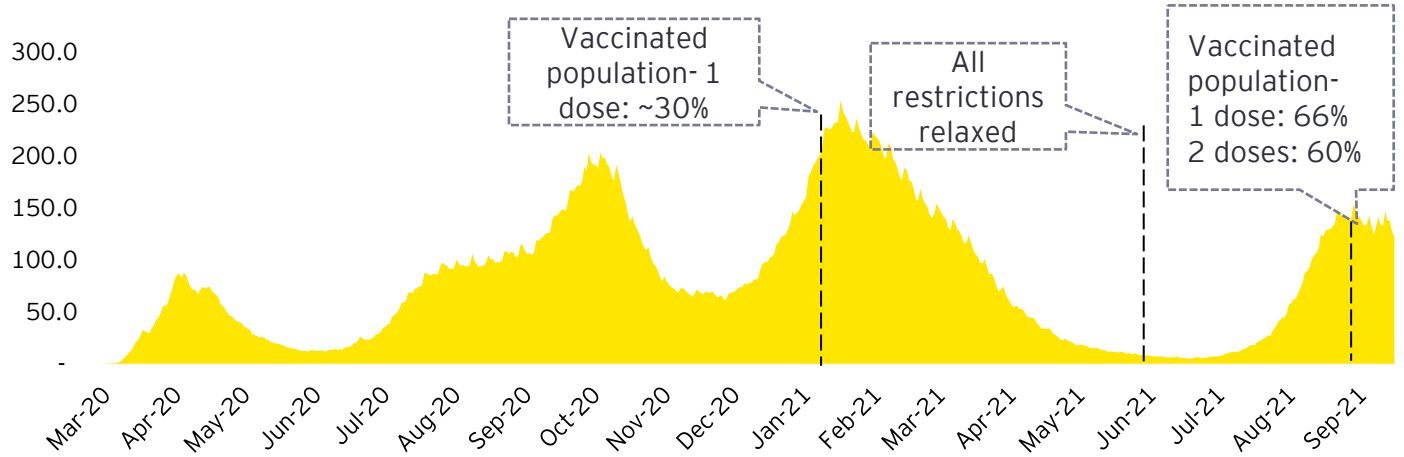
Country/ State	COVID Wave (Daily cases)	Key characteristics of third wave/ reasons being attributed
Israel		► Despite high vaccination coverage (~66% vaccinated with one dose, ~60% vaccinated with 2 doses), Israel seeing a surge in daily cases and hospitalizations from Jul'21 ► **Early relaxation of restrictions and waning immunity** have been cited as possible reasons for the surge

Key takeaways/ implications for India

► Measures including indoor masking, restrictions on mobility and public gatherings was completely relaxed from Jun'21 in Israel after >50% population was fully vaccinated → **Need to continue to impose targeted restrictions despite higher vaccination coverage**

Israel- Wave 1 period: Mar'20 to Oct'20; Wave 2 period: Nov'20 to Jun'21; Wave 3: Jul'21 till present

Hospitalized patients per million population



► Peak hospitalizations per million in wave 3 is ~0.8x compared to wave 1, when vaccinations had not begun (153 per million in wave 3 vs 203 per million in wave 1)

► However, peak hospitalization per million population as a % of peak daily cases per million population has seen a decline
  ► Wave 1 - 21%, wave 2 - 20%, wave 3 - 6% (~15% lesser than previous waves)

COVID Vaccination % as on 15th Sep 2021

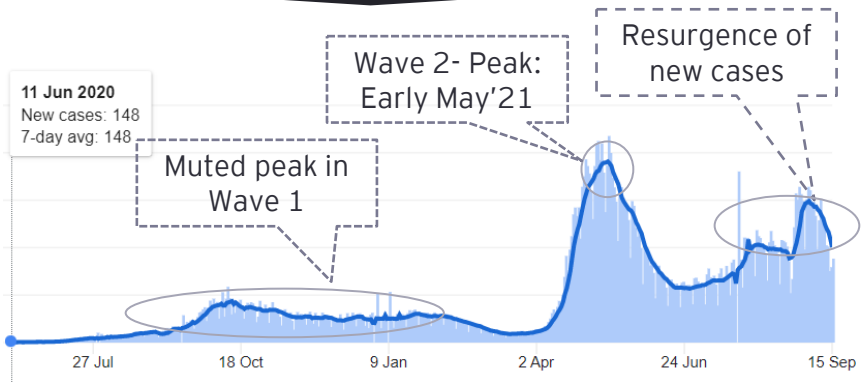
Source: ourworldindata.org, https://www.npr.org/sections/goatsandsoda/2021/08/20/1029628471/highly-vaccinated-israel-is-seeing-a-dramatic-surge-in-new-covid-cases-heres-why, https://www.nytimes.com/interactive/2021/world/covid-vaccinations-tracker.html?auth=link-dismiss-google1tap, Secondary Research

Kerala: rising trends in daily new cases despite having one of the highest vaccination coverage among Indian states, being linked to low seroprevalence

Country/ State

Kerala

COVID Wave (Daily cases)



State	Seroprevalence (% of popn.)	R Factor	Vaccinated (Once)	Vaccinated (Twice)
Andhra Pradesh	70%	1	45.8%	20.5%
Assam	50%	0.87	49.5%	11.5%
Bihar	76%	0.69	29.8%	6.5
Chhattisgarh	75%	2.4	27.8%	9.8%
Gujarat	75%	0.7	49.7%	18.9%
Jammu and Kashmir	63%	1.3	46.9%	17.8%
Jharkhand	61%	0.9	31.0%	8.4%
Karnataka	70%	1.1	50.6%	18.2%
Kerala	44%	1	66.1%	26.6%
Madhya Pradesh	79%	1	49.0%	11.9%
Maharashtra	58%	0.96	40.4%	15.4%
Punjab	67%	0.78	39.4%	12.7%
Rajasthan	76%	0.99	47.3%	16.4%
Tamil Nadu	69%	1.1	35.3%	9.2%
Uttar Pradesh	71%	0.92	31.7%	6.5%
West Bengal	61%	0.8	33.0%	13.3%

Key characteristics of third wave/ reasons being attributed

- Low **seroprevalence 44.4%** compared to national average of 68% → lower herd immunity
- Government concessions/relaxations for Bakrid, Sabarimala pilgrimage

Key takeaways/ implications for India

- Monitoring R factor, Seroprevalence and positivity rates could help prioritize regions with greater potential spread of infections.
- **However inconsistencies in state-level testing and reporting would not allow for any conclusive interpretations.**

No correlation between Seroprevalence, R Factor and Vaccination coverage

- Kerala: High vaccination coverage, but seeing rise in new cases due to low seroprevalence
- Bihar: Poor vaccination coverage but has higher seroprevalence

COVID Vaccination % as on 15th Sep 2021

1. Seroprevalence % (as per 4th National Seroprevalence Survey, Jun-Jul'21) indicates the presences of antibodies against Covid19
2. Reproduction no. R: A measure that highlights that number of people a coronavirus positive person can infect

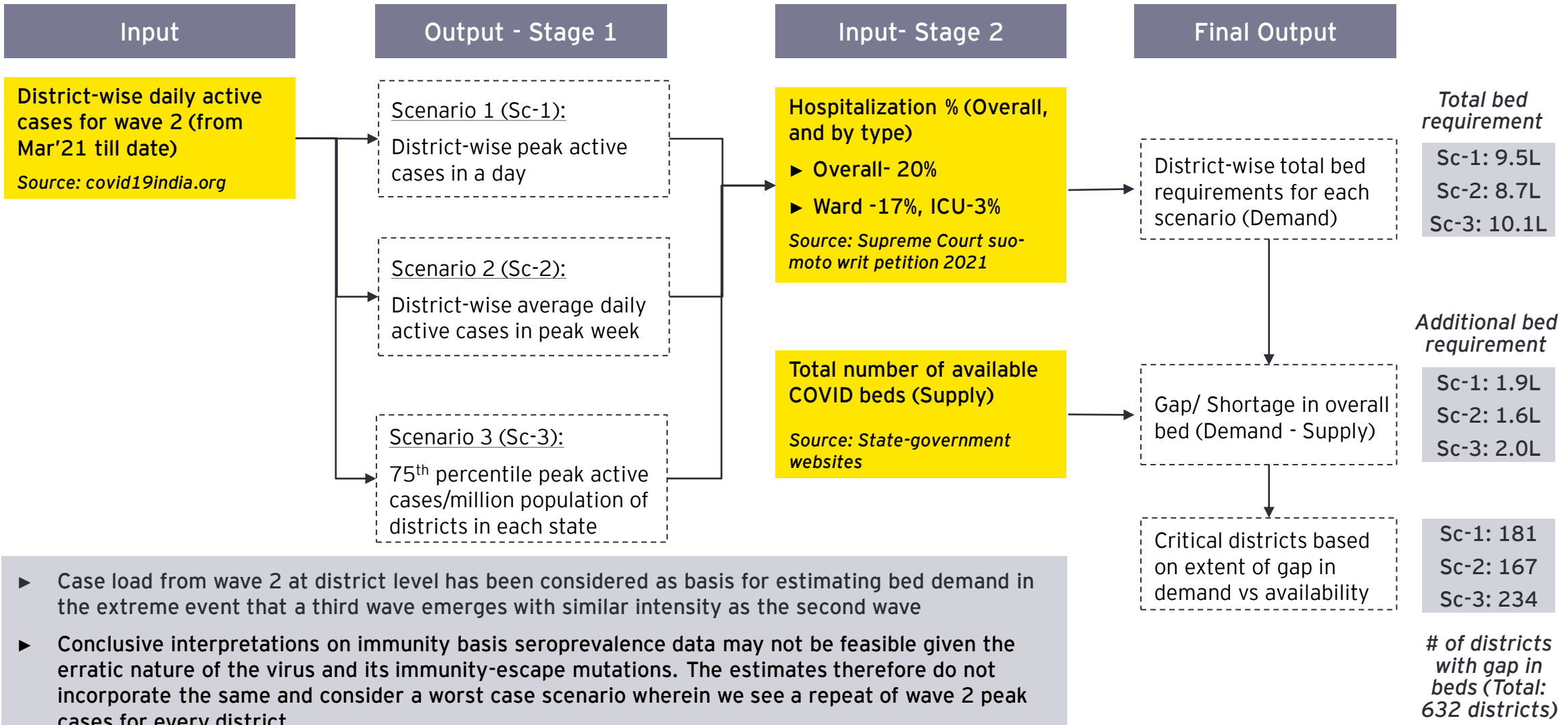
Source: Ministry of Health GOI, ourwordindata.org, Secondary Research

3

In the extreme event that a third wave emerges with similar intensity as the second wave with a peak of ~4L daily cases, an estimated 9–10L COVID beds may be needed implying a shortfall of ~2L beds. However, if the third wave manifests with 50% lower incidence and 50% lower hospitalizations, with ~2L daily cases, current infrastructure can be used to manage the demand of 3–4L COVID beds



Approach undertaken for estimating demand-supply gap in COVID beds (extreme event scenario if third wave manifests with similar intensity as second wave)

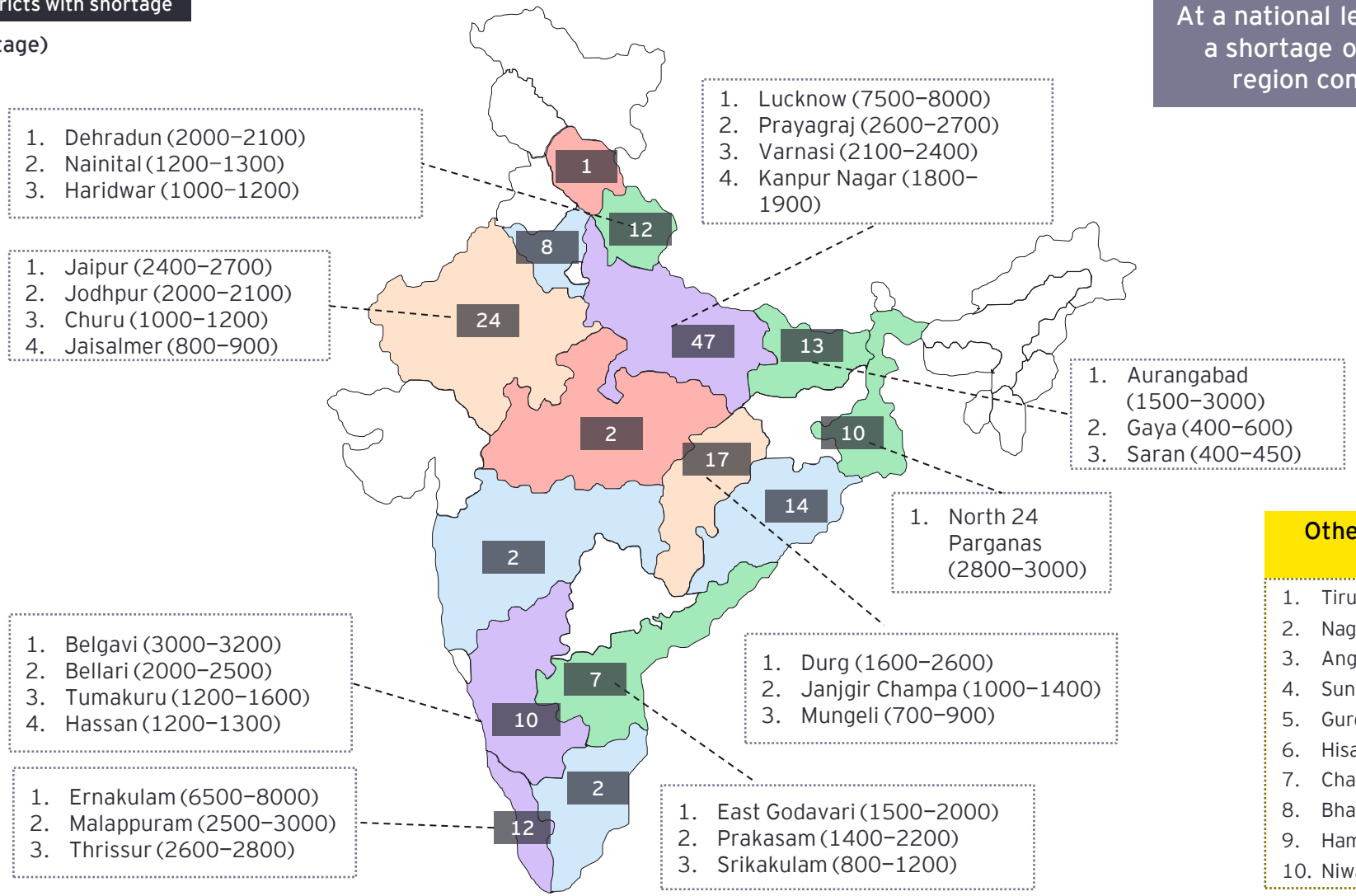


- Case load from wave 2 at district level has been considered as basis for estimating bed demand in the extreme event that a third wave emerges with similar intensity as the second wave
- **Conclusive interpretations on immunity basis seroprevalence data may not be feasible given the erratic nature of the virus and its immunity-escape mutations. The estimates therefore do not incorporate the same and consider a worst case scenario wherein we see a repeat of wave 2 peak cases for every district.**

Karnataka, Kerala, Uttar Pradesh among states which have districts with maximum shortage in COVID beds

No. of districts with shortage

(bed shortage)



1. Dehradun (2000–2100)
2. Nainital (1200–1300)
3. Haridwar (1000–1200)

1. Lucknow (7500–8000)
2. Prayagraj (2600–2700)
3. Varnasi (2100–2400)
4. Kanpur Nagar (1800–1900)

1. Jaipur (2400–2700)
2. Jodhpur (2000–2100)
3. Churu (1000–1200)
4. Jaisalmer (800–900)

1. Aurangabad (1500–3000)
2. Gaya (400–600)
3. Saran (400–450)

1. North 24 Parganas (2800–3000)

1. Belgavi (3000–3200)
2. Bellari (2000–2500)
3. Tumakuru (1200–1600)
4. Hassan (1200–1300)

1. Durg (1600–2600)
2. Janjgir Champa (1000–1400)
3. Mungeli (700–900)

1. Ernakulam (6500–8000)
2. Malappuram (2500–3000)
3. Thrissur (2600–2800)

1. East Godavari (1500–2000)
2. Prakasam (1400–2200)
3. Srikakulam (800–1200)

At a national level, 180–200 districts may have a shortage of 1.6L–2L beds with the South region contributing to ~55% of the gap

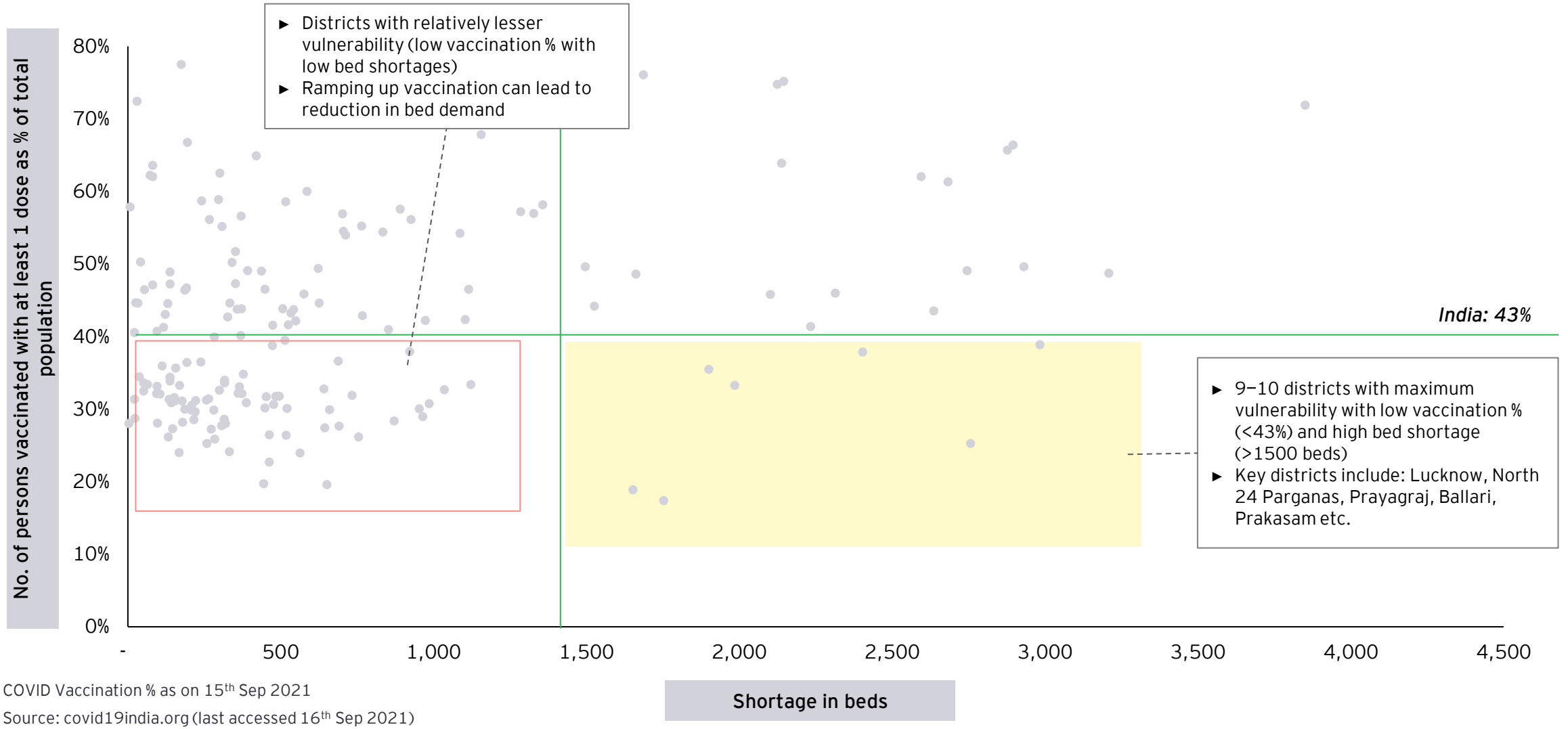
Bed-shortage- State level

- <500
- 1000–5000
- 5000–10000
- 10000–20000
- >=20000
- Insufficient/no data

Other key districts with significant bed shortages

1. Tiruppur TN (1300–1500)
2. Nagapattinam TN (100–150)
3. Angul OD (800–900)
4. Sundargarh OD (450–500)
5. Gurgugram HR (1500–1600)
6. Hisar HR (420–480)
7. Chandrapur MH (800–1000)
8. Bhandara MH (200–260)
9. Hamirpur HP (200–400)
10. Niwari MP (150–160)

9–10 districts with low vaccination percentage and high bed shortage to be prioritized in terms of pandemic preparedness and vaccination ramp-up



COVID Vaccination % as on 15th Sep 2021

Source: covid19india.org (last accessed 16th Sep 2021)

As vaccination coverage improves across the country, estimated demand for COVID beds is expected to reduce due to decrease in hospitalization rates

Note: All calculations have been done at a district level, values below indicate summation of values for individual districts

	Estimated bed demand for extreme event scenario if third wave manifests with similar intensity as second wave	Scenario 1: Impact of vaccination reducing hospitalization rate from 20% to 10%	Scenario 2: Impact of vaccination reducing peak case load by 50% and hospitalization rate from 20% to 10%
Peak active cases (summation by district) *Source: covid19india.org*	47L *Peak daily infections: ~4.1L/day*	47L *Peak daily infections: ~4.1L/day*	24L *Peak daily infections: ~2L/day*
Hospitalization rate	20% *Source: Supreme Court suo-moto writ petition 2021*	Vaccinated: 10% Unvaccinated: 20% *Source: ICMR and CDC studies indicating that hospitalization rate in breakthrough infections (i.e vaccinated people getting infected) is around 10%*	Vaccinated: 10% Unvaccinated: 20%
		Assuming 65–70% of population fully vaccinated by end of year[1]	
Estimated bed demand (summation by district)	9 – 10 L	6 – 7 L	3 – 4 L
Estimated shortfall in beds (summation by district)	~2L (180–200 dist.)	~0.7L (100–110 dist.)	<10k (30–35 dist.)

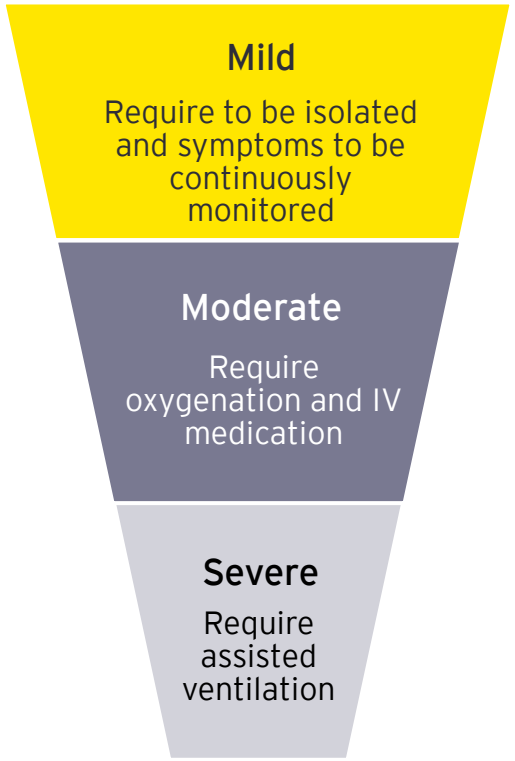
1 Govt aims to fully vaccinate all of its adult population by end of year - https://scroll.in/latest/995292/top-10-covid-updates-well-be-able-to-vaccinate-all-adults-by-the-end-of-2021-says-harsh-vardhan

4

Moderate cases not requiring immediate critical care can be managed in an intermediate/ transition care facility with provision for oxygenation instead of hospital wards. Part of the shortfall in COVID beds can be managed through these transition care centers which will help free up beds and resources in hospitals to be utilized for more severe cases



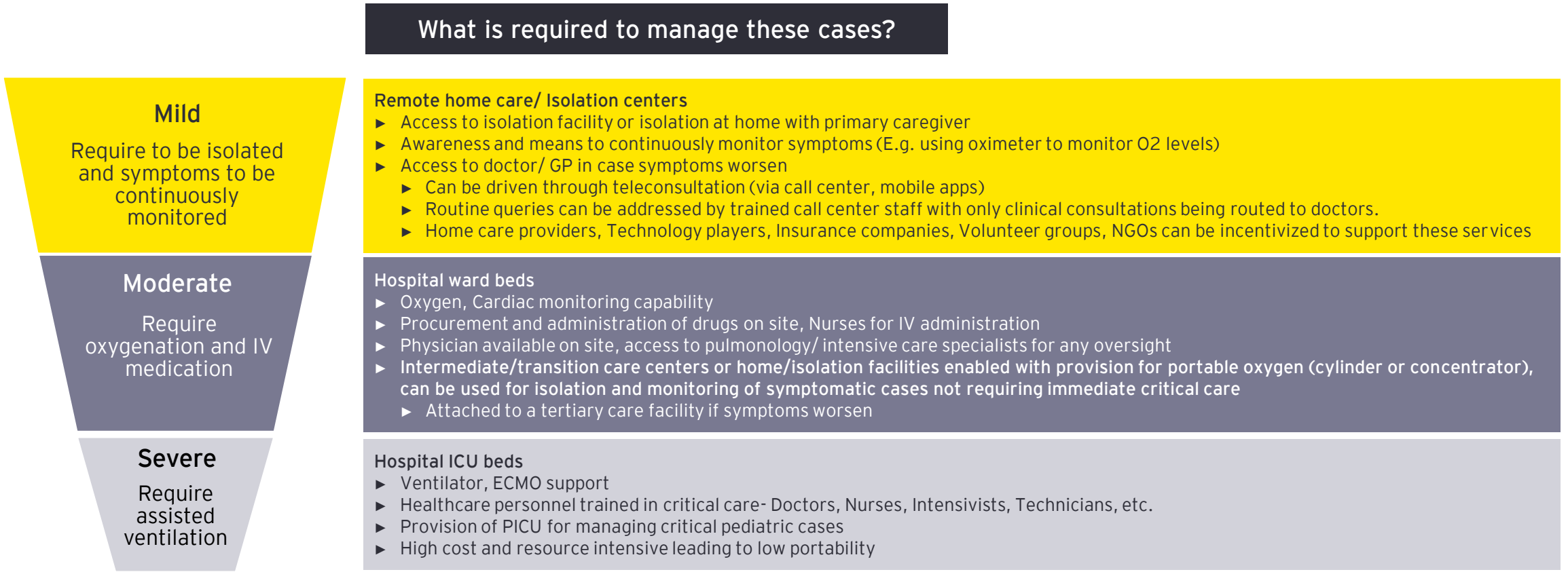
Comparison of hospitalization rates across countries indicates that ~80% of COVID patients may not require any hospitalization



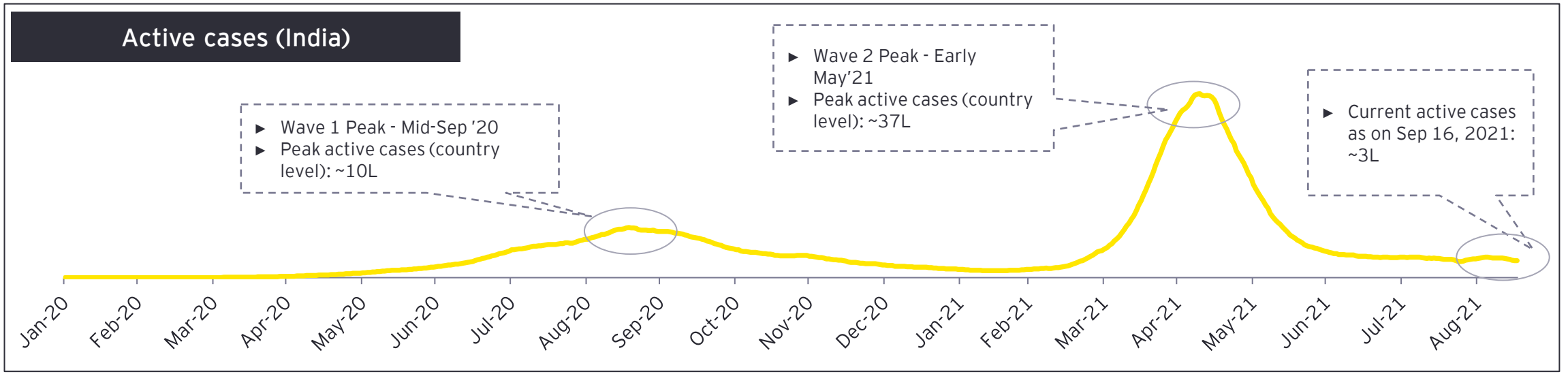
	UK[1]	US[2]	China[3]	Tamil Nadu[4.5]	Delhi[4.5]	Kerala[4.5]	Used for demand estimation[6]
Mild	86%	86%	81%	84%	79%	85%	80%
Moderate	9%	12%	14%	13%	14%	14%	17%
Severe	5%	2%	5%	3%	7%	1%	3%

1 %Moderate: Hospital new admissions/New cases in Jan'21 (wave 2 peak month), %Severe: As per UK Medical Research Council, 1 in 2 hospitalized patients developed at least 1 complication in the UK
2 As per US CDC (Interim Clinical Guidance for Management of Patients with COVID19); % of cases reported in Jan – May 2020
3 As per US CDC (Interim Clinical Guidance for Management of Patients with COVID19); based on a cohort study of 44,000 COVID19 patients in China
4 %Moderate= No. of occupied general beds with oxygen/No. of active Cases as on May 20th for TN, May 14th for Kerala, Delhi
5 %Severe = No. of occupied ICU and ventilator beds/No. of active cases as on May 20th for TN, May 14th for Kerala, Delhi- from State Government website and covid19india.org
6 As per categorization of COVID19 cases by the Supreme Court constituted Empowered Group 1, Suo-moto writ petition 2021

Low cost intermediate or transition care centers can serve as an alternative to hospital ward beds for managing moderate cases



Transition care centers can offer a scalable option towards 'surge capacity' in case the third wave sees a similar intensity as wave 2



- Active case load has drastically dropped from peak of ~37 lakhs in early May'21 to ~3 lakhs as of Sep'21, which is less than 1/10th of wave 2 peak. If the current case load continues, existing infrastructure would be able to absorb the demand for COVID beds.
- However, in the event that we have a third wave with similar intensity as that of wave 2, there may be a potential shortfall of ~2L beds across 180–200 districts as indicated in the previous section.
- COVID intermediate care centers can be created to address this 'surge capacity' this were to happen. Existing infrastructure of hotels, guest houses, community club houses etc. can be utilized to create this capacity for handling moderate COVID cases thereby offering a scalable and low cost option compared to traditional hospital set-up.
- Certain threshold parameters (for e.g. positivity rate, average occupied oxygenated beds etc.) can be pre-defined to serve as a potential trigger or inflexion point to determine the right timing to start creating these transition care facilities so that there is adequate preparedness when case load starts increasing exponentially.
- In order to meet the objectives of the COVID intermediate care centers, clinical criteria (for e.g. SPO2 levels, respiratory rate, lung imaging etc.) for admission and transfer for step-up/step-down care of patients would need to be pre-defined and adhered to.

Source: covid19india.org (last accessed 16th Sep 2021)

While many countries created temporary COVID care facilities, most sought to address comprehensive treatment including critical care similar to a hospital

Country	Wuhan	Wuhan	Mumbai	Delhi	Russia	UK	US
Facility	Huoshenshan, Leishenshan	Fangcang	BKC Jumbo	Sardar Patel Covid Care Center	VDNKh	ExCel Centre	US Navy Ship "Comfort"
# of Beds	1,000 – 1,600	~13,000	~2,000	~10,000	~1,200	~4,000	1,000
Objective / type of care	Isolation facility	Isolation facility (for mild, moderate cases)	Comprehensive COVID19 treatment centre including critical care	Comprehensive COVID19 treatment centre including critical care	Started as isolation facility (for mild, moderate cases), expanded to provide intensive care	Critical care (largest critical care unit in the world when inaugurated)	Isolation, critical care
Patients served	2000 – 3000	~16,000	~23,000 *(as of May-21)*	~12,000 *(Jul'20 – Feb'21)*	NA	4,000	182
#, type of medical staff	1,400 – 2,000, military medical staff	NA	329 doctors, 330 nurses, 31 technicians, 30 admin, 60 consultants	Indo-Tibetan Border Police medical staff	1,041 specialists, including 272 doctors, 450 nurses and 200 orderlies	~16,000 staff	NA
Initial set-up cost	RMB 360m (~INR 400Cr.)	NA	~INR 54Cr.	NA	NA	NA	NA
Set-up time	10–12 Days	~30 hours	15 days	10 days	16 days	9 days *(for first 500 beds)*	NA
Period utilized	Jan'20 – Apr'20	Feb'20 – Apr'20	May'20 – present	Jul'2020 – Present	Oct'20–NA	Apr'20–Present (for vaccinations)	Mar'20 – Apr'20
		Only mild/moderate cases					

Source: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30744-3/fulltext; https://www.cbc.ca/news/world/russia-covid-19-pandemic-vaccine-hospitals-1.5806172; EY Analysis

Wuhan, China: "Fangcang" shelter hospitals were created to exclusively cater to mild/moderate cases enabling greater vacancy in hospitals for critical care (1/2)

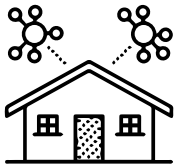
1 Surge of infections in Wuhan led to shortage of hospital resources



~60%

Of all confirmed cases in China were from Wuhan, the epicenter of the pandemic *(as of Mar'20)*

2 Majority of mild/moderate patients were therefore directed to home isolation



~80%

Of COVID-19 patients were directed to home isolation

3 But home isolation presented its own set of challenges

- Risk of transmission to family
- Difficulty in frequent monitoring, timely referral, medical care
- Lack of discipline by isolated patients to follow guidelines
- Psychologically taxing



"Fangcang" shelter hospitals were built by converting large public venues such as stadium, exhibition centers into temporary hospitals exclusively for mild/ moderate patients

Source: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30744-3/fulltext; EY Analysis

Key advantages over traditional hospital facilities

1. **Low cost**
   - Low cost of investment as already **existing facilities repurposed** instead of building new infrastructure
   - Low running costs as these hospitals have **low health-worker to patient ratio** (owing to low patient acuity)
2. **Rapid development + Large scale deployment** → 16 hospitals **(~13,000 beds)** were erected over a period of **3 weeks**

Wuhan, China: "Fangcang" shelter hospitals were created to exclusively cater to mild/moderate cases enabling greater vacancy in hospitals for critical care (2/2)

5 Essential Functions of the Fangcang

Isolation
- Greater risk of community transmission by mild/moderate patients as they are generally more active
- More effective compared to isolation at home

Triage
- Mild/moderate patients meeting admission criteria isolated in Fangcang
- Only severe/critical patients referred to traditional hospitals – reduced pressure on hospital resources

Basic Medical Care
- Medication (antiviral, antipyretic, antibiotic, IV fluid)
- Oxygen supplementation
- Mental health counselling

Monitoring & Referral
- Key vitals measured multiple times a day to monitor disease progression
- Patients transferred to higher level hospitals if any of pre-defined clinical criteria met

Social Engagement
- Intended to promote patients' recovery and enhance emotional well-being
- Community activities – Eating together, watching TV, dancing, celebrating birthdays etc.,

Admission criteria to Fangcang

- ✓ Positive COVID-19 test with mild symptoms (no signs of pneumonia) or moderate symptoms (fever, respiratory tract symptoms, imaging shows pneumonia)
- ✓ Ability to walk and live independently
- ✓ Absence of severe chronic diseases/comorbidities
- ✓ No history of mental health conditions
- ✓ <65 years old
- ✓ Negative influenza test
- ✓ SpO2 >93% and breathing rate <30 beats per min in resting state

Criteria for monitoring disease progression

Respiration rate	30bpm or higher
Blood oxygen saturation	93% or lower
Partial pressure of arterial oxygen to fraction of inspired oxygen	300mg Hg or less
Lung imaging of lesions	Greater than 50% progressions of lesions within 24–48h
Identification/development of severe chronic diseases	Hypertension, diabetes, cancer, coronary heart disease, structural lung disease, pulmonary heart disease, immunosuppression

Impact

4% → Increased vacancy rate of traditional hospitals within a month → 16%

Source: https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(20)30744-3/fulltext; EY Analysis

Manchester, UK: NHS Nightingale North West– Field hospital was built in 14 days to provide COVID-19 step down care to free up critical care beds

The NHS aimed to supplement capacity in the system with step-down beds for post-critical care of COVID patients



750
beds

357
staff members on day 1

Key functions

- **Basic Medical Care**
  - Medication
  - Oxygen supplementation
  - Rehabilitation support
- **End of Life Care**
  - Palliative care support
  - Bereavement support (for families)

Operating/Admission criteria
✓ Tested positive for COVID-19
✓ >18 years, no underlying conditions requiring level 2 care
✓ No bariatric requirements, no maternity
✓ Expected discharge date of 5–8 days at most
✓ No isolation requirements
✓ Plain imaging - ideal; 5 – 8L of oxygen through concentrators or cylinders

Key lessons

1. Hub & Spoke
Closer the field hospital is to the existing secondary/tertiary care hospital -> faster transfer of patients, movement of staff, supplies/equipment

2. Governance & Management
Strong programme governance with clearly defined roles & responsibilities for the leadership team with SOPs for the staff

3. Workforce
Right staffing model depending on complexity of care and efficient scheduling; use of support workers/volunteers, training-up staff from other services wherever required

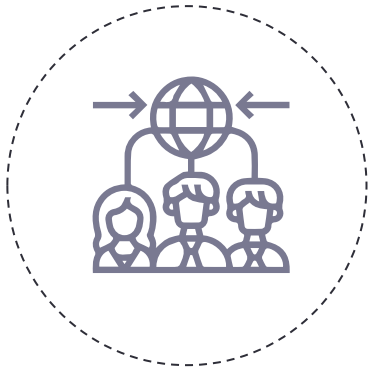
4. Procurement of resources
Build a strong, clinically supported procurement and logistics team with clearly defined objectives to address uncertainty/lack of resources

5. Health and safety of staff – IPC (infection prevention & control)
Clear pathways and procedures for IPC to promote welfare, safety and protection of staff

Source: https://www.manchestereveningnews.co.uk/news/greater-manchester-news/gallery/huge-new-hospital-manchester-city-18083385, https://www.nationalhealthexecutive.com/articles/nhs-nightingale-north-west-reopen, EY Analysis

Mumbai, India: decentralized war rooms instead of one single control room significantly reduced delays and case severity progression

Centralized Case Management – single control room for entire city of Mumbai

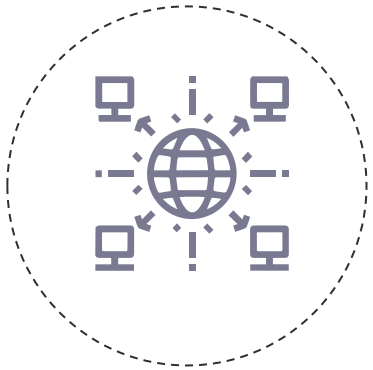


Overwhelmed Central Control Room → Delays in case management → Increased case severity

- Centralized case management (Reporting of cases – categorizing RT-PCR test reports, triaging and management of cases, hospital beds, oxygen allotment, at a city level) → led to **overwhelming of the central control room causing delays**, which in turn worsened the case severity of patients

Handling ~10k RT-PCR reports per day - by 1 facility

De-centralized Case Management – war rooms for each ward (24 wards) of Mumbai



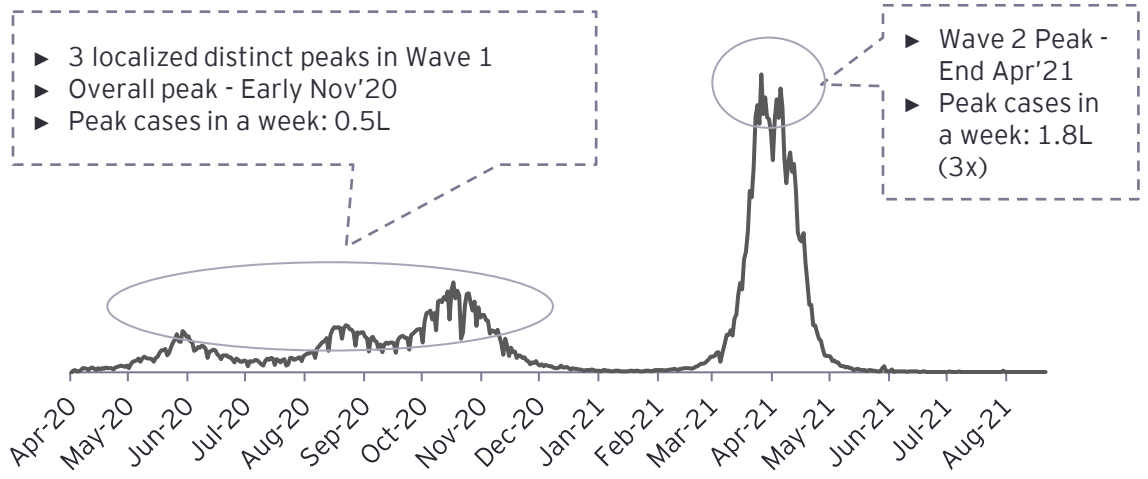
Individual ward 'war rooms' → Faster response time → Reduced case severity

- Decentralized approach (24 war rooms in each municipal ward of Mumbai) with a **localized decision making authority**, led to **efficient triaging** of cases with better bed, oxygen allocation, reporting of tests
- Each war room equipped with multiple phone lines, doctors and trained staff (24x7) (to triage cases, allot ICU or oxygen beds only to serious patients), dashboard of hospital beds and network of ambulances run → led to efficient case management and reduced case severity progression
- Bangalore has also implemented the same method following Mumbai

Handling ~450 RT-PCR reports per day - by 1 war-room

Source: https://www.moneycontrol.com/news/opinion/management-lessons-from-the-mumbai-model-to-tackle-covid-19-6939141.html, Secondary Research

Delhi: graded response action plan for COVID third wave implemented by the state government



Metric	Delhi	India
Peak month cases per mn popn. (wave 1)	9,405	1,942
Peak month cases per mn popn.(wave 2)	31,461	6,679
% infected population in wave 1	3.32%	0.8%
% infected population in wave 2	3.89%	1.5%

Delhi, one of the worst affected cities in both wave 1 and wave 2, has taken proactive measures and drafted graded response action plan for a possible third wave

Graded response action plan for COVID third wave by Delhi Disaster Management Authority

Color Code	Positivity Rate (in 2 consecutive days)	Average Oxygenated Bed Occupancy (in 7 days)	Cumulated new positive cases (in 7 days)	Suggested Key Measures
Yellow Alert	>0.5%	500	1,500	▸ Construction & Manufacturing activities will be allowed ▸ Private offices can open with 50% of staff ▸ Delhi metro will be operational with 50% capacity ▸ Shops selling non-essential goods can open between 10AM and 8PM ▸ Restaurants and Bars can open with 50% capacity ▸ Gyms, Cinema and Entertainment halls will be shut
Amber Alert	>1%	700	3,500	▸ Delhi metro will be operational at 33% capacity ▸ Buses at 50% capacity and restricting in selling hours for non-essential goods
Orange Alert	>2%	1,000	9,000	▸ Construction can be operational if labourers are on-site ▸ Manufacturing of essential good can only continue ▸ Stand alone shops selling non-essential goods will be allowed
Red Alert	>5%	3,000	16,000	Same as Orange Alert with tightened restrictions

Source: https://www.thequint.com/coronavirus/delhi-passes-4-level-action-plan-to-tackle-covid-3rd-wave#read-more

Annexures



Definitions and objectives of key metrics used in this document

Metric	Definition	Objective
% infected population	Sum of daily cases/Population **(Wave 1: 0.8%, Wave 2: 1.5%)**	To understand the spread of infection ('infection prevalence')
% infected population in peak month	Sum of daily cases in peak month /Population **(Wave 1: 0.2% in Sep-2020, Wave 2: 0.7% in May-2021)**	To understand the spread of infection in the peak month
Peak active cases in a day	Max of daily active cases (ie), Confirmed-Recovered-Deceased **(Wave 1: 10.1L Wave 2: 37.4L)**	To understand the maximum hospitalization requirement in a day
Peak active cases in a day per mn. popn	Max of daily active cases/Population million. **(Wave 1: 754 per mn, Wave 2: 2,771 per mn)**	To compare different districts/states basis the peak active cases
Average daily active cases in peak week	Average of daily active cases in the peak week **(Wave 1: 10L in Mid-Sep'20, Wave 2: 37L in Mid-May'21)**	To understand the average daily hospitalization requirement in the peak week
Peak cases in a week	Sum of daily cases over 7-day period **(Wave 1: 6.5L, Wave 2: 27.4L)**	To understand the new infections in a week and pace of the spread
Peak month cases per mn. Popn	Sum of daily cases over 30-day period in peak month/Population million. **(Wave 1: 1,942 per mn, Wave 2: 6,679 per mn)**	To compare different districts/states basis the total infections in peak month

Values indicated in brackets are for India-level; Wave 1 period: Apr'20–Feb'21; Wave 2 period: Mar'21–Jul'21

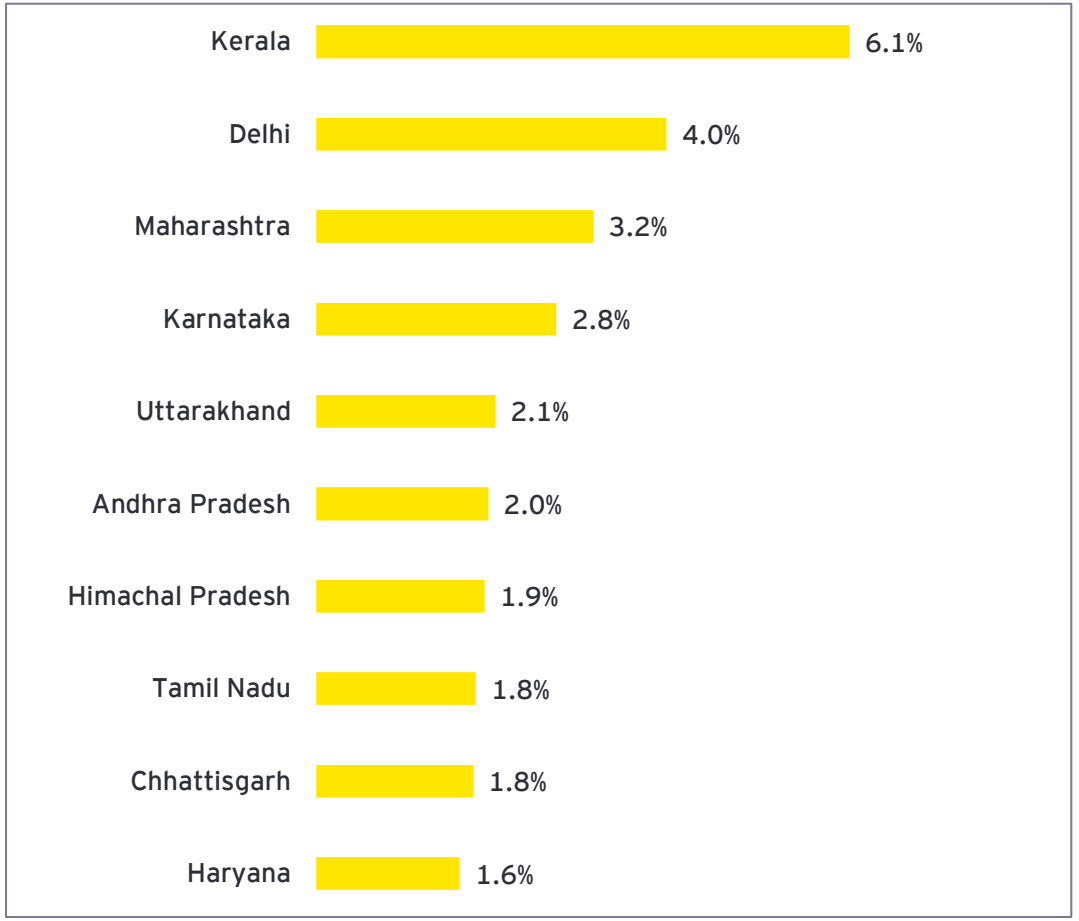
Notes: UK: % Infected population: 0.5% (Wave 1 Jan'20–Aug'20), 6% (Wave 2 Sep'20–Apr'21)

US: % Infected population: 1.8% (Wave 1 Jan'20–Aug'20), 8.1% (Wave 2 Sep'20–May'21)

Source: ourworldindata.org, UK Coronavirus Website, CDC COVID19 Surveillance Dashboard, covid19india.org (last accessed 16th Sep 2021)

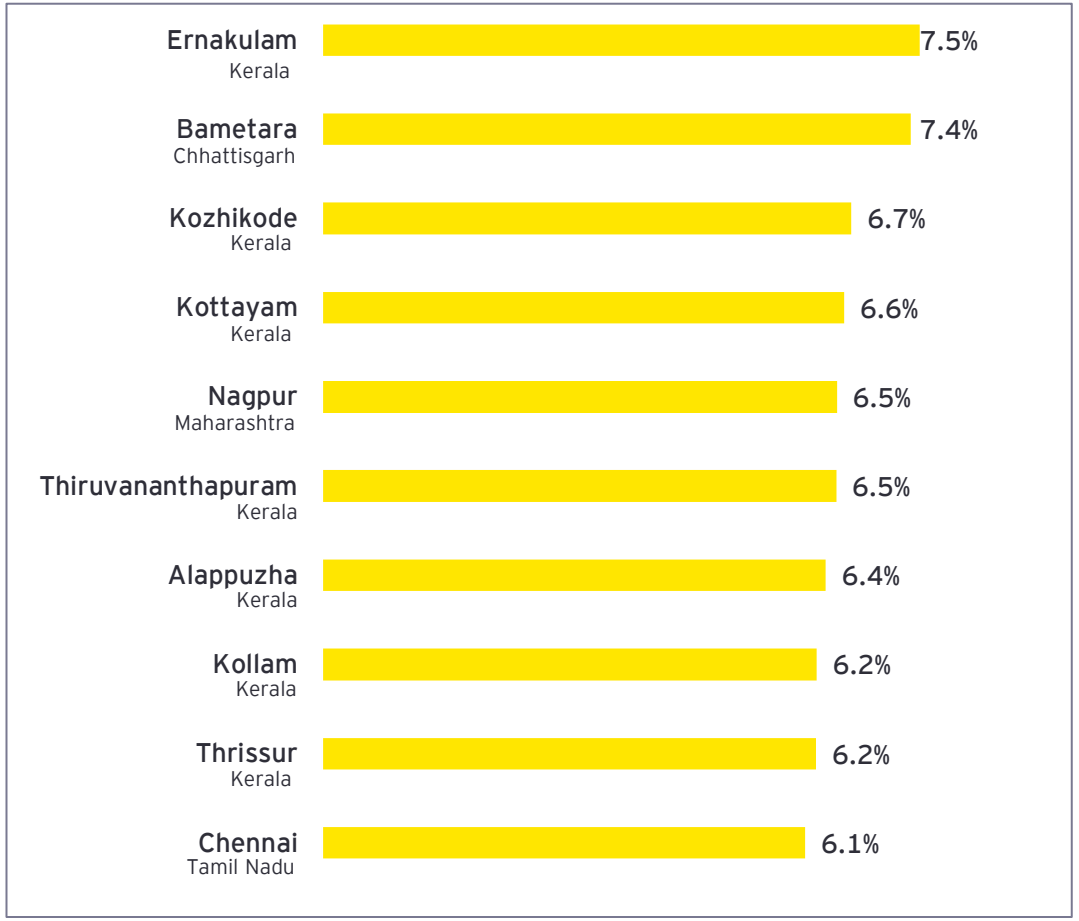
States and districts which showed high infections in wave 2

Top 10 States - % infected population in wave 2



Source: covid19india.org (last accessed 16th Sep 2021)

Top 10 Districts - % infected population in wave 2



Indicated are only mainland states; Worst affected union territories -Lakshadweep (14%) Puducherry (5%), Ladakh (3%), Chandigarh (3%)

Many expert groups have also cited non-homogeneity of pandemic progression across states

Expert group	Opinion
ICMR[1]	► **Nobody can predict the third wave for the whole country** ► It is important to not talk of India as a whole and to instead take a state-specific view when talking about COVID-19 because all the states are not homogeneous ► Every state should look into their number of COVID-19 infections and its intensity in both the first and the second wave of the pandemic to decide about their strategy/pandemic preparedness for the possibility of the third wave
Expert group from University of Michigan, University of Massachusetts[2]	► There is **enormous variation across Indian states in the magnitude, severity and stage of the COVID-19 pandemic**. ► That is why national data is of limited use in either understanding the progression, or in formulating policies for containment and mitigation of the pandemic.
Expert group from JNU, IIT Kharagpur, Kabi Sukanta Mahavidyalaya WB[3]	► Study conducted by the expert group found positive spatial heterogeneity in COVID-19 cases in India – 'A space-specific policy strategy would be a more suitable strategy for reducing the spatial spread of the virus in India'
Prof. Gautam Menon, Dept. of Physics & Biology, Ashoka University[4]	► It is **impossible to predict a wave of infections in advance, since this really is a random event**. Models cannot make long-term predictions because things change over time.
Paper published by Thapar Institute of Engineering & Tech.[5]	► The **progression pattern of the pandemic also turned out to be heterogeneous in each region of the country**, which therefore demands the analysis of chronological heterogeneity in the regional and state-specific level

[1]https://www.indiatvnews.com/news/india/covid19-third-wave-predictions-icmr-statement-coronavirus-cases-730389 **(Aug 31, 2021)**, https://timesofindia.indiatimes.com/india/3rd-wave-could-be-less-severe-than-2nd-one-icmrs-panda/articleshow/85754159.cms **(Aug 30, 2021)**

[2]https://thewire.in/health/covid-19-india-national-data-state (Jun 13, 2020), https://www.medrxiv.org/content/10.1101/2020.05.25.20113043v1.full.pdf (May 27, 2020)

[3]https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-021-10491-8 (Mar 31, 2021)

[4]https://www.downtoearth.org.in/interviews/health/-sutra-modellers-claim-of-india-reaching-herd-immunity-last-september-was-wrong--76825 (May 7, 2021)

[5]https://assets.researchsquare.com/files/rs-666506/v1/1f1ae858-b9e4-47da-a617-c555a5bba518.pdf?c=1631885508 (June 29, 2021)

Most expert groups believe that wave 3 is not likely to be as severe as wave 2 while also citing that virus mutations and lockdown relaxations could be key drivers

Expert group	Timing predicted	Severity predicted	Reasons for severity prediction	Possible drivers for third wave	Suggested measures
ICMR[1]	Late August – October	May be less severe compared to second wave	► Considerable population in states not affected severely in wave 2 did not have/had minimal exposure to infection, making them vulnerable	► Emergence of mutant that is able to escape the immunity ► Easing of restrictions ► Waning of immunity acquired though infection and vaccination	► District level situation assessment and measures must be taken ► Ramping up vaccination ► Avoiding mass congregations
Prof. Manindra Agrawal (IIT Kanpur)[2]	Peak by November	Similar to first wave *Up to 150k infections/day*	► There might be a third wave which might peak in November if there is a new virulent variant more infectious than existing ones ► There might be no third wave if no new variant more infectious than Delta emerges	► Emergence of new variant of SARS-CoV-2 more infectious than Delta variant	
Reuters poll of medical experts[3]	By October	Weaker than second wave	► Cases will be less than second wave due to more vaccinations and natural immunity from second wave	► Easing of restrictions ► Slow vaccinations	► Increasing vaccination rate of adults ► Vaccinating children
AIIMS[4]	Mid August, Peak in October	Not as severe as second wave		► Virus mutation ► People not following safety measures	► Public adherence to COVID-appropriate behavior ► Vaccinating children as they are 'more susceptible'

[1]https://www.thehindu.com/news/national/interview-a-third-covid-19-wave-can-make-its-appearance-felt-as-early-as-late-august-says-dr-samiran-panda/article35390889.ece,

[2]https://www.india.com/news/india/third-wave-may-peak-by-november-if-more-virulent-variant-emerges-says-scientist-4907797/,

[3]https://www.reuters.com/world/india/india-should-brace-third-covid-19-wave-by-oct-say-health-experts-2021-06-18/,

[4]https://zeenews.india.com/india/covid-19-third-wave-depends-on-people-s-behaviour-aiims-director-randeep-guleria-2384704.html, https://www.india.com/news/india/third-wave-of-corona-in-india-expected-date-aiims-director-randeep-gulerias-big-statement-people-should-not-ignore-read-details-4889979/

Acknowledgements

We are grateful to the following people for strategic direction, contribution and constant guidance for the paper.

1. **Mr Subhrakant Panda**, Vice President, FICCI
2. **Dr Mahesh Joshi**, President and CEO, Apollo Homecare

Special Gratitude to

1. **Dr Harish Pillai,** Chair- FICCI MVT Committee and Former CEO, Aster DM Healthcare India (Now- CEO, Metro Pacific Hospital Holdings Inc., Manila)
2. **Dr Sanjeev Singh**, Chief Medical Superintendent, Amrita Hospital Ghaziabad

FICCI COVID Task Force Members

1. Chair- **Mr Subhrakant Panda**, Vice President, FICCI
2. **Mr A Vaidheesh**, Former MD GSK and President OPPI
3. **Dr Bishnu Panigrahi**, Group Head- Medical Strategy and Operations, Fortis Healthcare
4. **Dr Harish Pillai,** Chair- FICCI MVT Committee and Former CEO, Aster DM Healthcare India (Now- CEO, Metro Pacific Hospital Holdings Inc., Manila)
5. **Mr Kaivaan Movdawalla**, Partner- Healthcare, EY
6. **Dr Mahesh Joshi**, President and CEO, Apollo Home Healthcare
7. **Mr Mohammad Ameel**, Head- Primary Healthcare, Technology & Innovations, PATH
8. **Dr Om Manchanda**, Managing Director, Dr Lal PathLabs
9. **Dr Priya Abraham**, Scientist G & Director, ICMR National Institute of Virology (NIV), Pune
10. **Mr Simpson Emmanuel**, Managing Director, Roche India
11. **Dr Sharvil Patel**, Managing Director, Cadila Healthcare Ltd

Acknowledgements

FICCI Secretariat

12. **Mr Dilip Chenoy,** Secretary General, FICCI
13. **Ms Jyoti Vij,** Deputy Secretary General, FICCI
14. **Mr Manab Majumdar,** Deputy Secretary General, FICCI
15. **Mr Praveen K Mittal,** Senior Director, FICCI
16. **Ms Shilpa Sharma,** Consultant- Health Services, FICCI

EY Team

Core team

- Muralidharan Nair
- Kaivaan Movdawalla
- Srimayee Chakraborty
- Tara Ravi
- Ramprabu T
- Shrenivass JK

Writing and editing team

- Vikram Choudhury

Design team

- Rajeev Birdi

Brand and marketing team

- Sanam J Shah

Ernst & Young LLP

EY | Building a better working world

EY exists to build a better working world, helping to create long-term value for clients, people and society and build trust in the capital markets.

Enabled by data and technology, diverse EY teams in over 150 countries provide trust through assurance and help clients grow, transform and operate.

Working across assurance, consulting, law, strategy, tax and transactions, EY teams ask better questions to find new answers for the complex issues facing our world today.

EY refers to the global organization, and may refer to one or more, of the member firms of Ernst & Young Global Limited, each of which is a separate legal entity. Ernst & Young Global Limited, a UK company limited by guarantee, does not provide services to clients. Information about how EY collects and uses personal data and a description of the rights individuals have under data protection legislation are available via ey.com/privacy. EYG member firms do not practice law where prohibited by local laws. For more information about our organization, please visit ey.com.

Ernst & Young LLP is one of the Indian client serving member firms of EYGM Limited. For more information about our organization, please visit www.ey.com/en_in.

Ernst & Young LLP is a Limited Liability Partnership, registered under the Limited Liability Partnership Act, 2008 in India, having its registered office at 22 Camac Street, 3rd Floor, Block C, Kolkata - 700016

© 2021 Ernst & Young LLP. Published in India.
All Rights Reserved.

EYIN2110-013
ED None

This publication contains information in summary form and is therefore intended for general guidance only. It is not intended to be a substitute for detailed research or the exercise of professional judgment. Neither EYGM Limited nor any other member of the global Ernst & Young organization can accept any responsibility for loss occasioned to any person acting or refraining from action as a result of any material in this publication. On any specific matter, reference should be made to the appropriate advisor.



About FICCI
Established in 1927, FICCI is the largest and oldest apex business organisation in India. Its history is closely interwoven with India's struggle for independence, its industrialization, and its emergence as one of the most rapidly growing global economies.

A non-government, not-for-profit organisation, FICCI is the voice of India's business and industry. From influencing policy to encouraging debate, engaging with policy makers and civil society, FICCI articulates the views and concerns of industry. It serves its members from the Indian private and public corporate sectors and multinational companies, drawing its strength from diverse regional chambers of commerce and industry across states, reaching out to over 2,50,000 companies.

FICCI provides a platform for networking and consensus building within and across sectors and is the first port of call for Indian industry, policy makers and the international business community.

www.ficci.com