The Urban Dimension of COVID-19

Covid Outbreak and Lessons for Future Cities

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Living through the COVID-19 pandemic feels like the worst nightmares of our lifetime. But it is also an opportunity for us to reflect and re-visit the infrastructure priorities of cities, their governance processes, and more broadly, the vulnerabilities of urban communities in an increasingly globalized and connected world. As the pandemic expands its footprint across India, it has become apparent that the megacities are worst affected, with half of the country's COVID cases reported from just the four cities of Mumbai, Delhi, Chennai, and Ahmedabad. With the "engines of economic growth" coming to a halt and authorities struggling to deal with the health emergency, it is incumbent on us to re-imagine our city planning principles and approaches. We also need to enforce resilient urban development models that could prepare cities to adapt to various kinds of shocks and stresses (e.g. floods, pandemics, heatwaves, droughts) that are becoming the new normal.

This article aims to emphasize and translate the urban dimension of the COVID-19 outbreak in India and identifies key trends across geographies and time. It offers a hierarchical- State-district-city level analysis, combining demographic data from the Census of India 2011, COVID-19 statistics from the Ministry of Health and Family Welfare (MoHFWA), Government of India and Covid19india.org (a volunteer-driven open COVID data initiative). To begin with, a longitudinal analysis of State level COVID cases is presented to provide an understanding of how the States have performed over time in their effort to stabilize the growth of cases and "flattening the curve". The paper maps the share of cases contributed by megacities within each State, highlighting how the location of large urban centres impacted their performance. It, then present, a district-level outlook of COVID-19 spread and a correlation analysis examining whether the districts with higher urbanization rate has experienced more intense outburst in cases. The article also engages with the Top 100 cities by Census population to examine the intensity of outbreaks across megacities, and also maps the houseless population and families living in slums who are most vulnerable to the pandemic and severely impacted by the ongoing lockdown. The concluding section offers key recommendations for re-imagining Indian cities and their planning standards in the post-COVID era.

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The State-level COVID-19 trends

The latest data released by the MoHFWA (available at www.mohfw.gov.in) suggest that India's COVID-19 tally have crossed over one lakh on May 18[2]. A quick look into the geographic distribution of cases shows that nearly 70% of cases in India are recorded from Maharashtra, Tamilnadu, Gujarat, and Delhi. Maharashtra alone has contributed 1 out of every three cases reported in India. A more in-depth analysis of the intra-state distribution of cases reveals that an overwhelming number of cases have emerged from the large cities in the more urbanized States. Maharashtra, which recorded a massive 35,000 cases have the third-highest urbanization rate (45%) among the Indian States. Tamilnadu that records 11,760 cases is 48% urbanized, the second-highest among the States. Similarly, Gujarat, which reported 11,750 cases has an urbanization rate of 43%, much above India's average 31%. The analysis shows that megacities significantly drive the COVID numbers in these large, urbanized states. Ten megacities (with population over 10 million) in Maharashtra contributes an overwhelming 94% of all cases in the State. In Gujarat, 90% of the total cases have emerged from just four megacities. Likewise, 80% of cases in Madhya Pradesh are reported from four cities, and 70% of cases in West Bengal are concentrated in Just the two megacities.

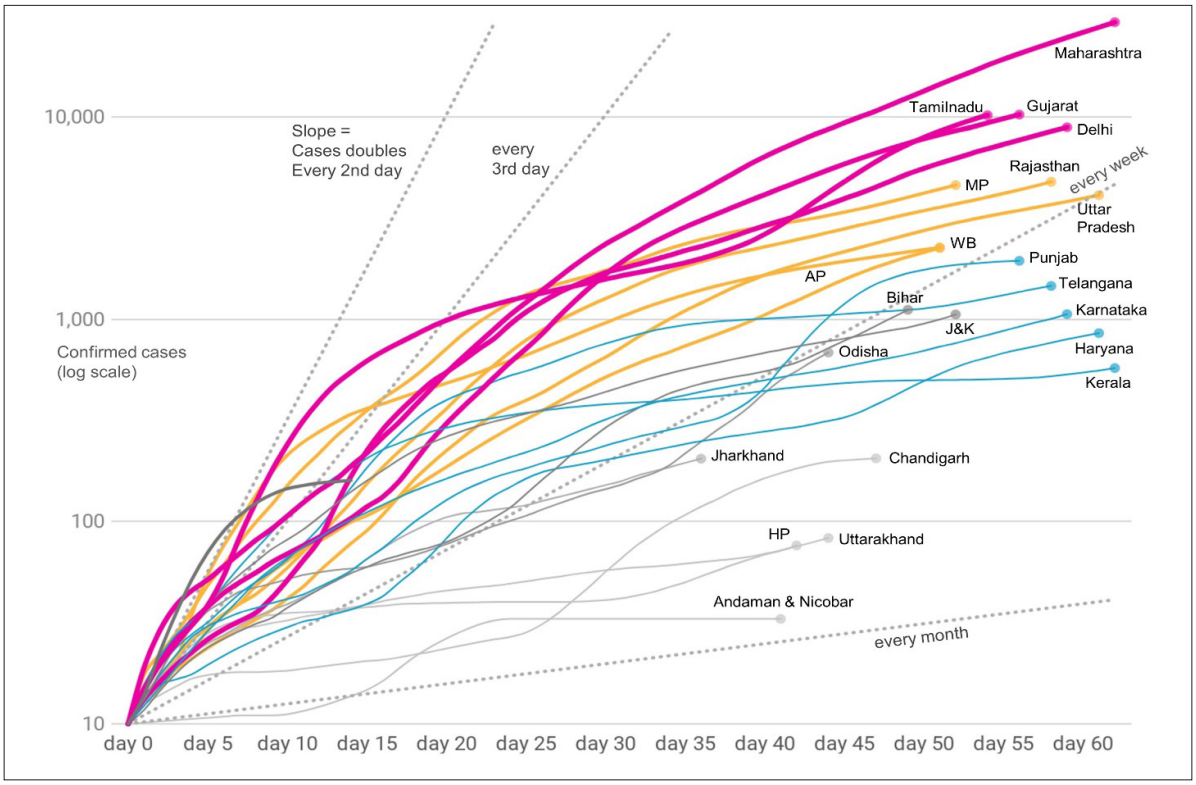
The trend analysis of the growth of cases conducted across States provides a comparative understanding of doubling time. The doubling time is a critical measure of how successful States are in containing the virus spread while limiting new daily recorded cases. The line chart highlights that Kerala, Karnataka, Haryana, and Telangana have successfully flattened the growth curve, after an initial outburst of cases. Opposingly, Maharashtra, Delhi, and Gujarat show a steeper-upward curve, indicating that they have consistently added a significant number of daily new cases within its megacities. Rajasthan, Madhya Pradesh, and Uttar Pradesh although have experienced a large number of new daily cases in the month of April, they have somehow been able to contain the increase of cases from early May, resulting in slowing of doubling time and a flatter growth curve. Tamilnadu has shown a more erratic trend, with substantial early cases in March, a slowdown in

Table 1: Share of COVID cases contributed by cities (>10 lakh population) to State totals

State	Confirmed Cases	No of 10 lakh+ cities	Total cases in 10 lakh+ cities	% share
Maharashtra	33,053	10	31,018	94%
Gujarat	11,380	4	10,209	90%
Tamil Nadu	11,224	3	7,066	63%
Rajasthan	5,432	3	2,959	54%
Madhya Pradesh	4,977	4	3,966	80%
Uttar Pradesh	4,464	7	2,178	49%
West Bengal	2,677	2	1,882	70%
Andhra Pradesh	2,432	3	875	36%

Analysis by Authors, Data Source: MoHFWA and covid19india.org

Figure 1: 7-day rolling average of confirmed cases in States
Days counted since the 20th case reported in respective States



Analysis by Authors, Data Source: MoHFWA

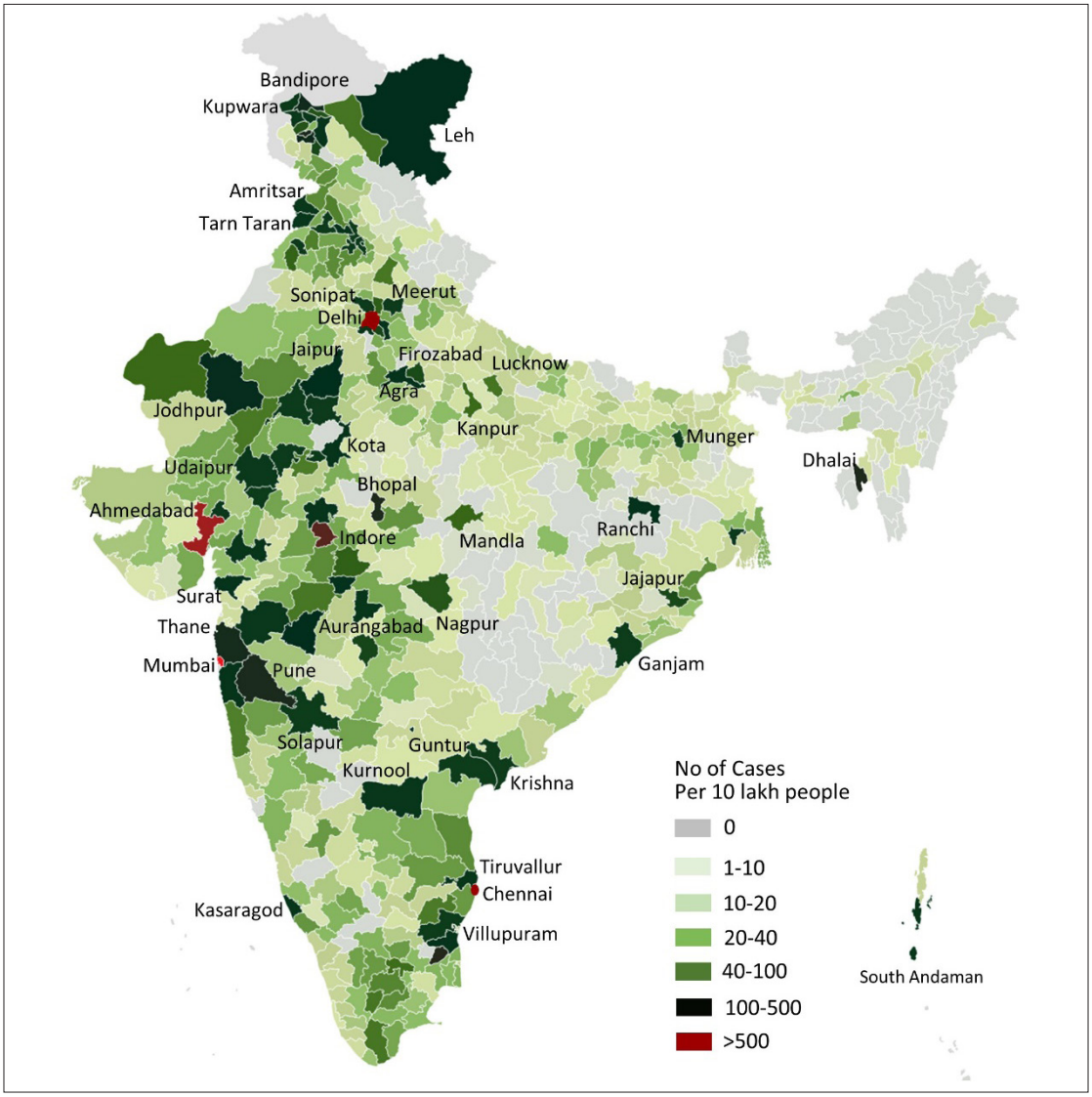
[2]*Data and analysis are based on data sourced till May 18, 12.00 AM.*

April, and a late surge in COVID cases in May. West Bengal is another such State which has experienced a sudden surge in cases from late April. The recent increase in cases in Tamilnadu and West Bengal have largely been reported from the two megacities of Chennai and Kolkata.

District-level COVID-19 outbreaks

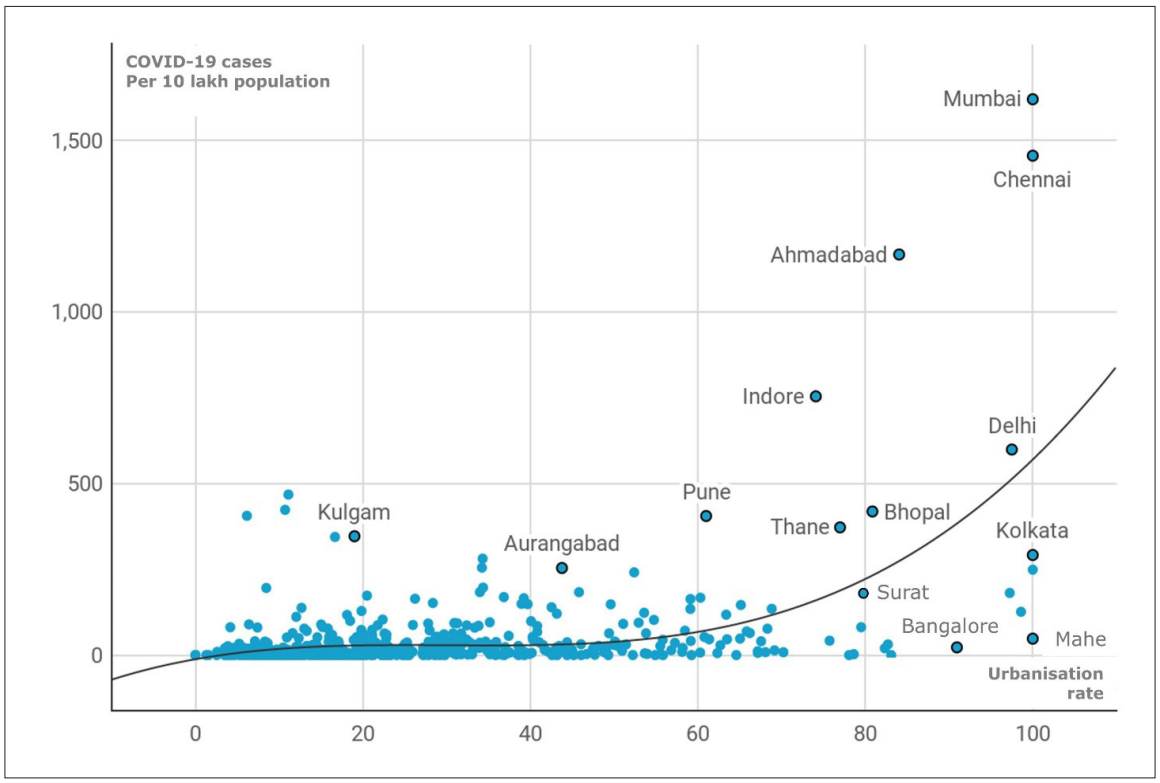
Mapping of the COVID-19 cases at the district level using the covid19india.org open data provides a detailed understanding of the micro-zonation of the pandemic in India. Considering the vast difference in population size across districts in India, we have normalized the actual number of COVID-19 cases to the respective district population, which gives a more objective and logical basis for comparison across the sub-state geographies. The analysis reveals that Mumbai city and suburban districts together have the highest 1620 cases per 10 lakh population. Chennai (Tamilnadu) and Ahmedabad (Gujarat) districts records 1455 and 1170 cases per 10 lakh people. Indore district (Madhya Pradesh) also has a very high 750 cases per 10 lakh inhabitants, followed by NCT of Delhi (615). Five districts have reported between 400-500 cases per 10 lakh people, including Ariyalur (Tamilnadu), Dhalai (Tripura), Bhopal (Madhya Pradesh), Shupiyan (J&K) and Pune (Maharashtra). The districts of Thane (Maharashtra), Kulgam (J&K), Bandipore (J&K), Kolkata (West Bengal), Jodhpur (Rajasthan), Leh-Ladakh, Aurangabad (Maharashtra), Hyderabad (Telangana) and Jaipur (Rajasthan) all have between 200-400 COVID positive cases per 10 lakh people. Other notable districts where a significant number of cases (>150 cases per 10 million residents) emerged are Agra (UP), Ranchi (Jharkhand), Chandigarh, Surat (Gujarat), Kota (Rajasthan) and Ujjain (Madhya Pradesh). Some of the populated districts that have reported less than 10 cases are Bokaro (Jharkhand), Thrissur (Kerala), Rangareddy (Telangana), Bardhhaman (West Bengal) and Ernakulam and Thiruvananthapuram in Kerala.

Figure 2: 7-day rolling average of confirmed cases in States



Analysis by Authors, Data Source: covid19india.org

Figure 3: Correlation between district level urbanisation rate and COVID cases



Analysis by Authors, Data Source: Census of India 2011 and covid19india.org

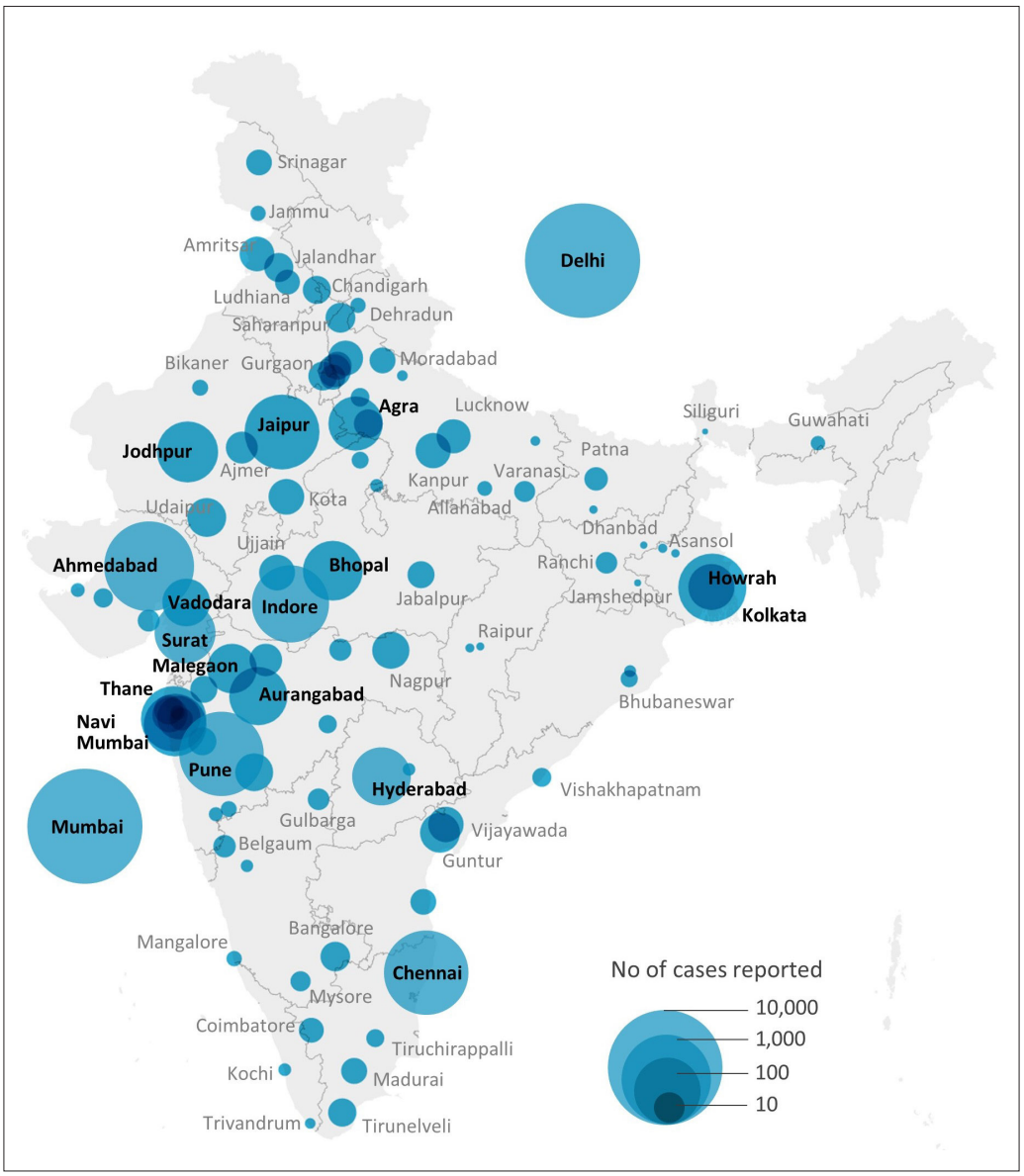
Although the district level mapping of COVID cases provided some understanding of the wide variations in the scale of the outbreak it could not pinpoint which factor has driven the magnitude differences. To this end, we performed a Pearson correlation analysis between the urbanization rate of districts (calculated from Census of India 2011 releases) and confirmed cases per 10 million population (compiled from covid19india.org data); and found that the more urban districts have been the worst hit by the pandemic. The urbanization rate of districts is computed as the share of urban population to the total district population as reported in the Census of India 2011. The analysis highlights that an overwhelming majority of the districts that have over 200 cases per 10 lakh people, including Mumbai, Chennai, Ahmedabad, Hyderabad, Indore, Thane, Bhopal and Kolkata are more than 75% urbanized. Districts such as Surat, Pune and Kota, Srinagar (J&K), SAS Nagar (Punjab) Jaipur and Amritsar (Punjab) which have over 50% of their population living in urban areas recorded over 100 cases per 10 lakh residents. Among the majority-rural districts, Dhalai, Shupiyan Ariyalur (Tamilnadu), Bandipore (J&K), Ladakh, Baramulla (J&K), Perambalur (Tamilnadu), Tarn Taran (Punjab), and Anantnag (J&K) has over 100 cases per 10 lakh people. These rural-dominated districts with high cases can be considered as outliers.

COVID-19 trends in Top 100 Cities

Crowdsourced data from Covid19india.org was used to assess the intensity of Coronavirus outbreaks across India's most populated cities and urban agglomeration areas. It revealed that over 90% of India's COVID cases are reported from the 100 most populated cities by the Census 2011 population. The biggest 20 cities together contributed a massive 74% of all India cases. Just the ten Municipal Corporations (MC) of Mumbai, Delhi, Ahmedabad, Chennai, Pune, Indore, Jaipur, Kolkata, Surat, Hyderabad and Jodhpur hosts 39,000 COVID confirmed cases, which is 65% of cases in India. As discussed in Section 2, these mega urban regions with a large concentration of infected patients have driven the State-level COVID-19 trends in India.

Among the MC's with over 20 lakh population highest number of cases was observed in Mumbai (21,335),

Figure 4: Confirmed COVID-19 cases in Top 100 cities by Census population (2011)

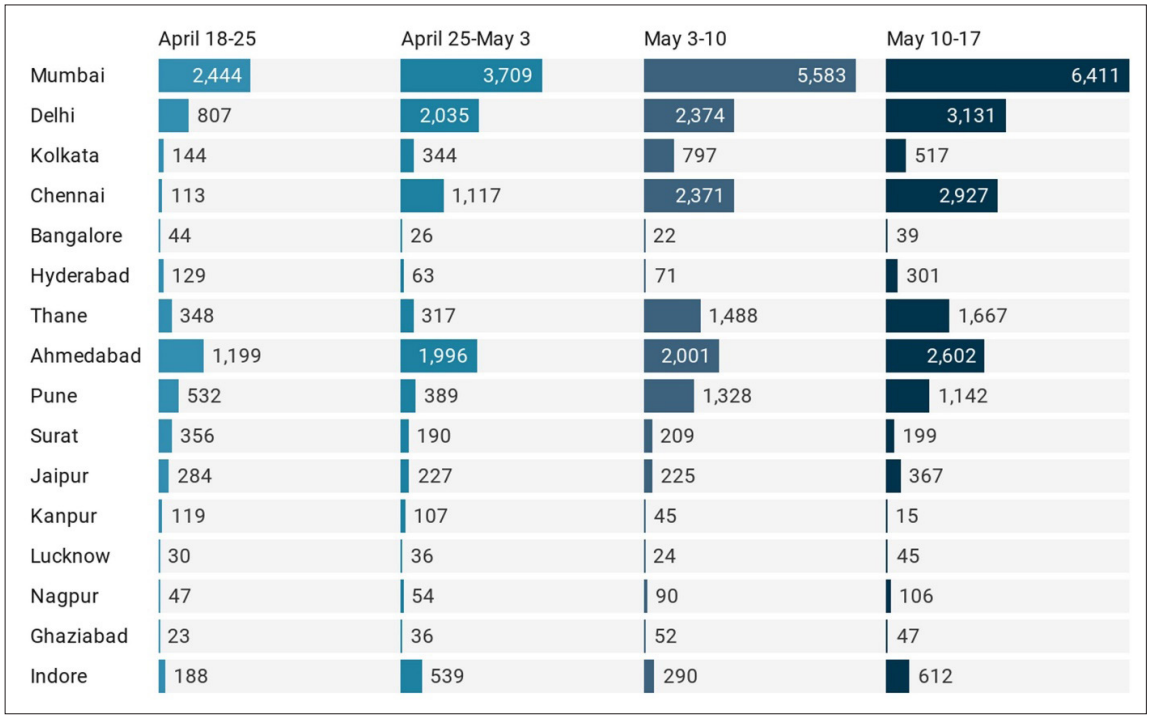


Analysis by Authors, Data Source: Census of India 2011 and covid19india.org

Ahmedabad (8,683), Chennai (7,125), Pune (3,308) and Jaipur (1,625). Opposingly, the cities in 20 lakhs plus population category that have done well to contain the spread of the virus were Bangalore (216), Lucknow (295), Nagpur (357) and Kanpur (316). As per the Census of India, there were 33 cities that have a population between 10-20 lakh in 2011. Eight out of these 33 cities recorded over 500 COVID cases, including Indore (2,565), Thane (1,200), Jodhpur (1,071), Bhopal (1,030), Navi Mumbai (1,100), Aurangabad (939), Agra (815), and Vadodara (681). The MC's that stand out in the 10 lakh-plus population category are Dhanbad and Raipur which have less than 10 cases as of May 18. Allahabad too, has done a tremendous job in holding the number of cases to less than 50. A number of successful stories emerge If we look at the City Corporations with a population between 5 to 10 lakhs. 24 out of the 42 MC's in this population size category have less than 50 cases, and 8 have an exceptional record of less than 20 cases, including Jamshedpur, Cuttack, Siliguri, Asansol, Guwahati, Durgapur and Bhilai Nagar.

In addition to the above analysis of the concentration of COVID cases across India's biggest cities, the weekly growth in new cases over the last month was mapped. This observation was done for the Top 15 Urban Agglomerations (UA) by the 2011 Census population to provide an understanding of how these megacities have performed over time to contain the virus spread. Mumbai, urban agglomeration area has consistently posted the highest number of cases over the last four weeks, and the situation appears to have intensified in the last two weeks where over 5,000 cases were added each week. Ahmedabad is also showing a worrying trend with an average of above 2000 weekly cases reported over the last three weeks. While Chennai was able to somewhat contain the virus until the end of April, the cases have exploded with an addition of over 5000 cases in the last two weeks. Pune and Thane have also experienced a late boom in newly reported cases in the last two weeks with the new addition of over 2,500 and 3,000 cases respectively. Bangalore, Lucknow,

Figure 5: Growth of weekly new cases in the Top 15 cities by Census population



Analysis by Authors, Data Source: Census of India 2011 and covid19india.org

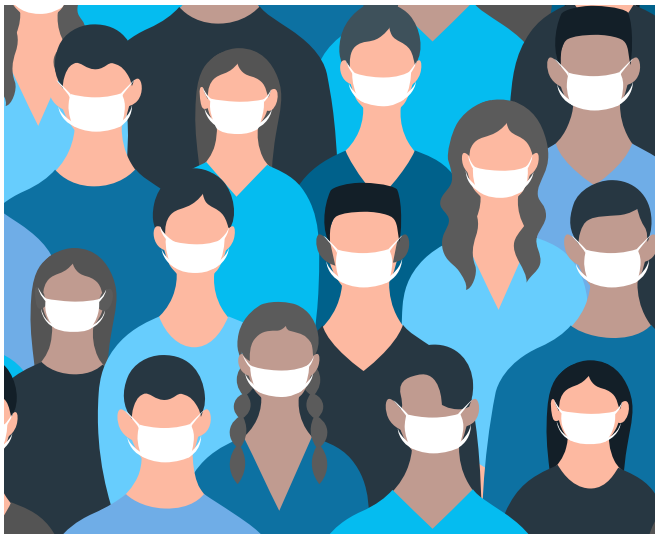
and Kanpur have somewhat beaten the trend among the TOP-15 urban regions in the country and shown a gradual decline in new reported cases over the last four weeks. In Kanpur, for example, 119 new cases were reported between April 18-25, which significantly reduced to 45 fresh cases in the week of May 3-10 and 15 cases during May 10-17. The cases in Bangalore also reduced to half during the same period, highlighting how the Southern city is leading the way in successfully implementing COVID containment strategies.

Key lessons and recommendations for future cities

The data and evidence presented in this article unequivocally establishes that the COVID-19 pandemic in India has taken its roots in cities and it is the mega urban regions where the battle is being fought. And thus, the evolving situation is proving to be a significant disruptive force for the "engines of economic growth" with transportation and movements coming to a standstill and jobs and services severely affected. The crisis has also revealed the deep-rooted-seated structural economic and social inequalities faced by India's urban poor, migrants, and laborers who are facing great difficulties in meeting daily ends. Many are also raising the issues of an overwhelming urban density and crowding in cities. And, above all, we are faced with the most critical question - "how resilient our cities are to emergencies"? The following paragraphs provide some reflections in this area while attempting to translate lessons learned from the COVID pandemic into strategies and potential solutions for structural change and reforms in urban governance and future planning processes.

Re-imagining cities and empowering urban local bodies

The current crisis has clearly demonstrated that large cities across India have been grossly underwhelming in their capacities to mobilize resources and implement strategies to contain the coronavirus. This should be seen in a broader context of their ability to respond to disasters and preparedness to face environmental, social, and humanitarian crises that are increasingly becoming new normal in cities across the world and in India. In the post-COVID-19 era, we must re-imagine our cities by introspecting on the capacities of Urban Local Bodies (ULB's) and put in place a system capable enough to take timely local action and unified approach to response and mobilizing resources (Vaidya, 2009; World Economic Forum, 2016). To this end, a critical review of the progress of structural reforms for devolving administrative, fiscal, and functional autonomy to municipalities and urban local bodies proposed under the 74th Constitutional Amendment Act (CAA) of 1993 is indispensable. It is high time to push for decentralized governance and strengthen local administration as sound bottom-up governance approaches have been more successful in the wake of disaster response. The triumphing story of Kasaragod in Kerala containing the initial spread of coronavirus is a perfect example, where decentralization of power from State to ULB level has taken place in the true



spirit of 74th CAA. It is also to be revisited how our cities can strengthen the Office of Mayor with provisions such as mandatory elections for the post, a more substantial 5-year term for an elected Mayor and benchmarks on the qualification of hiring of a mayor with more emphasis on education as similar to collectors and commissioners. A strong Mayoral office will help bridging multiple silos between Municipal departments and local overlapping authorities (like water supply and town planning) providing the ability for design-delivering cohesive, uniform, and swift response to urban challenges.

Mainstreaming health in the urban development agenda

With the COVID-19 pandemic expanding its footprint across Indian cities, we are faced with a critical question - "how do we create cities that are healthy"? Traditionally, health is not considered a core function of Municipalities and Local Corporations in Indian cities. The current crisis should be used as an opportunity to break away from this current and ULB's should be provided with the responsibility, resources, and capacities to lead and manage robust health infrastructure systems, including hospitals, public health workforce, medical information, and data systems, and public health laboratories. By doing so, our cities shall place people's health and life care needs at the heart of urban planning, development, and service delivery processes. Linking with the recommendations of the United Nations Habitat III Urban Agenda, Indian cities must re-align city plan-making and design processes to consider implications of planning decisions for human health and well-being. Mainstreaming health in the urban development agenda should not only be limited to the provision of health services but also focus on the quality of urban environments with lifestyle and dietary habits, which have come to the fore as a key determinant of human vulnerabilities to pandemic. Healthy cities by improving access to green and open spaces, for example, and controlling the sources of pollution – offers significant opportunities for improving health and economic productivity while negating economic costs (as perceived during this COVID lockdown). Focusing on health in Indian cities can unlock progress to reduce inequalities in urban areas, and expand access to services and opportunities while providing our communities the capacity to prevent disease, promote health, and prepare for and respond to both acute (emergency) threats and chronic (ongoing) challenges to health.

Moving from siloed to integrated urban and regional planning approaches

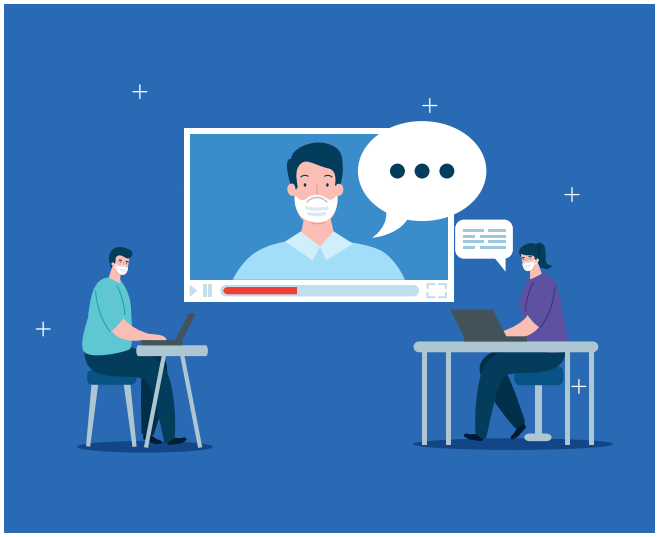
The ongoing scenario across Indian cities and States highlight that our policymakers and governments are yet to fully understand and fix the city – region nexus. Cities and regions have a series of underlying forward and backward linkages that sustain both the unique landscapes. While cities provide the jobs and educational opportunities, regions and hinterlands play a key role in supplying labour and ensures robust food supply chains to cities. The unfolding migrant crisis proves how our cities have exploited their rural companions and failed to even provide basic covers such as adequate housing for the poor. To address these challenges, Indian cities need to move from a fragmented and siloed planning system to a regionally integrated planning paradigm. Megacities of India are burdened with a plethora of policies and development plans. Some of these planning instruments emerge from National government schemes such as the Smart City Plan under the Smart Cities Mission (SCM), City Development Plan resulted from Jawaharlal Nehru National Urban Renewal Mission (JnNURM) and City Sanitation Plan as part of the National Urban Sanitation Policy. There are a number of State-driven plans that cities invest into, including Master Development Plans and Urban Utility (transportation, water supply) Plans. A number of cities have also ventured upon Environmental Plans and City Disaster Management and Resilience Plans often supported by global aid agencies. A common feature of these different planning instruments is that they are poorly coordinated across complex jurisdictional boundaries, and lack of convergence among proposals weakens our city's ability to deliver integrated future-proof solutions (Praharaj, et al., 2018). Also, it is important to consider that Urban Agglomerations in India normally groups several administrative bodies. As planning instruments frequently are carried out by different bodies, an agglomeration planning perspective is required. The reviewing, analysis, and synthesis of all existing planning instruments in each city is an essential step to provide strategies that are implementable on the basis of the public administration system. Once we emerge out of the pandemic, cities should revisit the planning processes and instruments and explore ways to consolidate integrated urban development plans. Such plans shall be re-imagined through the constitution of Metropolitan Planning Committees (MPC) and District Planning Committees (DPC) in line with the recommendations of 74th CAA to address the rural-urban interdependence, emphasize on housing for the poor and migrant laborers and evolve a coordinated regional growth strategy (Agarwala & Vaidya, 2020).

Building community resilience through digital technologies and big data

The COVID-19 pandemic underlines the need for our cities to incorporate resilience thinking into the way business is done. Resilience strategy embedded within the integrated development plans (discussed in the previous paragraph) shall chart out how cities will focus their efforts across sectors to be able to bounce back from both sudden shocks and slow-onset disasters. As part of building community resilience, urban authorities must explore the boundaries of digital technologies and big data and the ways they can be leveraged to improve cities capacities in preparing for and responding to emergencies. Many cities under the Smart Cities Mission have developed Integrated Command and Control Centre which are being used as COVID War Room (The Economic Times, 2020) for real-time data monitoring about the status of coronavirus cases in different administrative zones and wards through a central information dashboard. Information and Communication technologies in such War Room enables officials to track people under quarantine, suspected cases as well as GPS and CCTV monitoring of healthcare workers and COVID designated hospitals. Using advanced data analytics, the city administrators can develop containment plan and response strategies while seamlessly collaborating with the State and Central level agencies through web-technologies in these Command Centres. In the post-COVID era, cities must learn from each other about the use and benefits of these Command Control technologies, create digital capacities within local corporations to actively respond in real-time to events like pandemics and common disasters such as flood and heatwaves. In the age of Big Data, we shall also find newer ways to create population inventory and tracking mechanisms, especially of the migrants and urban poor who are often the worst hit in emergency situations. Just a quick look at the Census of India 2011 Household Series data (Household Series) show that nearly 40 lakh people live in slums and 3.5 lakh are houseless in the 20 largest metropolitan areas of the country. At this time of crisis, how would our governments reach out to these vulnerable communities? Digital object identifier technologies and GIS-based household registration database program that maps urban households and records population movements and migration to and from urban areas is the need of the hour. By using these advanced technologies and big human data systems our cities and state governments would be able to strengthen community resilience by creating capacities to proactively deal with situations and mechanisms for offering timely help to the needful (such as food and medicine supplies) during any crisis.

Using scenario planning tools for better preparing for emergencies

The current crisis shows that to respond adequately to an emergency of this kind our cities need better coordination mechanisms among a range of agencies, including the police, health administrators, Municipal authorities, and



State governments. Scenario Planning as a tool is an excellent medium to develop such coordinated response mechanisms in future cities. Scenario Planning and training exercises are a major part of emergency preparedness that aims to test and to improve emergency plans and prepare responders to deal with any incidents that may occur (Mayor of London, 2020). As a start point, Indian urban authorities shall create three to four city-specific scenarios/ stories of what kind of events might happen, then devise strategies and lay out responsibilities for each department to make the city more flexible and resilient in the face of each possibility. Such exercises shall be performed through live multi-agency simulations of a response to a major incident, like terrorist attacks or flooding or health contagion to train people on emergency protocols and help them understand what they need to do when things go wrong. Scenario planning tools and exercises shall also be used as a powerful immersive tool for engaging communities in emergency preparedness activities, so that they are aware of situations and are ready to act, should the worst happen. This helps people and organizations prepare logistical and mental resilience, while also providing an opportunity to explore new and engaging ways to carry out exercising and ensuring safety and reliability in city life.

A new planning guideline for urban form, density, and public spaces

The viral outbreak of COVID cases in the dense urban environments and slums in the sprawling cities of Mumbai, Kolkata, Chennai, Ahmedabad and others forces us to re-think the norms of urban form, planning and design. While it is true that large population concentration provides cities the scale that ensures economic viability of capital-intensive infrastructure, it is becoming apparent that when densities breach their critical mass, they have negative consequences on economic, environmental, health, and social sustainability. The time has come, then, to revisit India's Urban and Regional Development Plans Formulation and Implementation (UDRPFI) Guidelines and examine how it can lead the way for shaping a new kind of urban form and

density pattern that is less susceptible to shocks. Authorities in charge of UDRPFI and the Town Planning agencies at the metropolitan level shall take the view of urban density as a complex interaction between several forces and the way it impacts daily work and living in coming up with a new standard. Because, the idea is not to over-regulate developments but distinguish between a good urban density and a bad one. They should advocate for rich dense places, where people can shelter in place, work remotely, and still have all of their food and other needs accessible to them in time of a crisis, as opposed to poor dense places, which push people out onto the streets, forces them to walk miles to reach stores and onto crowded transit with one another. The time is ripe for urban planners to go back to the old school concepts of "Neighbourhood Planning" invented in the 1900s by Clarence Perry (Perry, et al., 1929) to address the kind of basic amenities and services that must be made available to communities for self-contained and functional neighbourhood living. In 30 years of existence of this much popular theory, we have become more and more reliant on the supermarkets and malls (often several kilometres drive away) for basic grocery shopping, only to return back to the small vendors next door when forced with the pandemic. Then, we must reflect on what kind of cities we are living in and how more integrated land use policies coupled with behavioural change could help us course correct.

In the quest for a new paradigm in planning standards, cities must also look for ways to make use of urban public spaces more flexible and fluid. Innovative concepts such as Pop-up parks and temporary local public spaces are the need of the hour in this new world of required social and physical distancing. Urban planning guidelines shall provide room for experimentation in the form of temporary redesign of public physical environments in the event of an emergency to make it easier for communities to stay informed and safe while having access to fresh air in the dense cities that we have landed ourselves into. Such design is important because our habits are triggered by cues built into our physical environment. If everything looks and feels the same, we will habitually revert to old behaviors. If we can make the necessary changes in the urban planning guidelines, adopt a new norm in urban density, be able to design quick, temporary solutions to alter and adjust our built environments, we can trigger better, more effective physical behavior, and in turn help our authorities to deal with disasters and emergencies efficiently.

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