Lessons COVID19 taught Urban Planners Case of Chandigarh, India

Dr. Prabh BEDI, Resonance Integrated Solutions, New Delhi, India

Dr. Mahavir, School of Planning and Architecture, New Delhi, India

Abstract

Rapid urbanization in recent decades has led to burst of economic activities in the urban areas leading to comparatively higher standards of living to a larger population but has led to environmental degradation as well, which can be primarily attributed to the decline in green spaces due to increasing pressures on maximizing the monetization of urban spaces. There is no denying that green spaces have health benefits, both mental and physical, to the residents of the urban areas. COVID19 has highlighted the pertinence of green spaces as an intrinsic element for maintaining the quality of life of the people and to make the urban spaces sustainable.

Chandigarh is one of the few planned cities of India. Now, a designated metropolis, it has experienced a surge in population growth, accommodating a million plus people as per the last census, with some pockets of remarkably high density. Further, the dependence on the city of its immediate and adjoining urban settlements has led to increased stress on its infrastructure. Chandigarh has area under urban greens as per the standards laid out nationally and internationally. These green spaces are distributed across the city at hierarchical levels, though equity of the same may be questioned. Over time, these spaces have emerged as melting pots of the city's culture, being used for some specific purposes, contributing to the city's wellbeing. The authors have researched upon the relevance and appropriateness of Chandigarh's Master Plan in the context of the pandemic and if the spatial spread of green spaces has contributed to containing the spread of COVID19. The sufficiency of the green spaces and its distribution across the city has been a question as well. Similarly, whether the distribution of densities influenced the spread of COVID19 has been examined. Further, it has been explored what needs to be essentially included in the plans of settlements to ensure the well-being of its people and enable the decision making to ensure well thought of spatial plans. The learnings can thus be adapted world over, appropriately modified to suit the local conditions.

Keywords

COVID19, Chandigarh, Urban Greens, Urban Planning

1. Introduction

COVID19 has brought the world to a standstill and has forced the professionals to rethink their strategies for the development of their urban areas in a sustainable manner. The crisis is still not over as some parts of the world are still reeling under the aftermath of this highly contagious disease. Some professionals have raised questions on city form and density while some have attempted to find solutions. In this research, impact of COVID19 has been investigated from the perspective of urban planners. The case study has been based on the planned city of Chandigarh, which has been built upon certain set parameters and standards. The authors have hypothesised that the high density does lead to spread of the diseases like COVID19 and the green spaces contribute towards mitigating the impact of the diseases on the well-being of the citizens. An attempt has been made to establish a correlation between high

density and green spaces with the spread of the pandemic. Learnings have been captured as decision-making input for the spatial plans that can be appropriately adapted across the world.

2. Chandigarh

Chandigarh is symbolic as the first 'planned' city in independent India. Planned on modernist philosophy of clearly distinguishing every activity, it is based on three main principles of human activity: living, working, recreation so as to bring order in the city and was conceived as a machine that works according to specific rules.

2.1. The Plan

Chandigarh was conceptualized as an urban organism with its major functions as living, working, circulation and recreation, being equated with different parts of human body. Neighborhood is the building block of the City's plan and a sector having a rectangular shape of about one square kilometer functions as one. Le Corbusier planned the Capitol Complex at the top resembling the head; the intellectual base, reflecting his conviction that governance should begin here as the head rules the body. Residential sector constituted the living part whereas the Capitol Complex, city centre, educational zone (Post Graduate Institute of Medical Sciences, Punjab Engineering College and Punjab University) and the Industrial Area constitute the working part. The Leisure Valley, gardens, sector greens and open courtyards were designed to represent the recreations areas. The circulation system comprised of 7 different types of roads known as 7 Vs. Subsequently, pathways for cyclists called V8 were added to the circulation system (Chandigarh Administration, 2016). Combining modernity with ecology, eight KMs long linear-park was planned running through the city from its north eastern tip to its south-western end forming the city level urban green.

The work place of the city, the industrial area comprised of 2.35 Sq. KMs, is located in the extreme southeastern side near the railway line. The location of the industrial areas was in conjunction with the prevalent wind direction of the area, which is north, north west. The area has been allocated and planned for non-polluting and light industry and is directly connected to the civic centre by a V-3 road. A wide buffer of fruit trees has been planted to screen off the industrial area from the rest of the city. Tree plantation and landscaping has been an integral part of the City's Plan.

The recently notified development plan of the city for the target year 2031 is an attempt to provide a comprehensive and holistic vision document based on exhaustive stocktaking of ground realities. The Plan articulates the development strategies and directions of future growth for the entire area under the jurisdiction of the Union Territory of Chandigarh. Among the various aspects emphasised in the Plan, the key focus is to develop the city in the context of the region that has emerged in the periphery in the adjoining states of Punjab, Haryana and Himachal Pradesh. The Plan adopts a population dispersion strategy with the development of new towns in its region. Further, the Plan intends to make the city more green, more eco-friendly, more people friendly, more walking and biking friendly. The intent is to improve the micro-environment and flora and fauna by creating city forests, while at the same time preserving the bountiful natural resources, green spaces and waterbodies (Chandigarh Administration, 2016).

2.2. Demography and Land Use

The original Plan of Chandigarh was prepared seven decades ago to meet the requirements of the Administrative City for a population of five lakhs. The 70 sq.km area acquired for the development of the first two phases (Sectors 1 to 47) of Chandigarh had clearly defined land use zones within the modular sectoral grid. The residential sectors are based on the concept of self-sufficient neighbourhoods each having schools, shops for daily needs, community centres and neighbourhood parks as essential green

spaces.

Despite Chandigarh being a planned city, it has not been able to avoid un-planned development. Due to lack of availability of low-cost housing and services for labour in the original plan, unauthorized settlements have surfaced which are being rehabilitated partly within the sectoral grid but mostly in the peripheral areas. An increase in the population density in the urban villages and its spill over to the surrounding areas has also been noted over the decades. The villages within the sectoral grid do not have any scope for horizontal expansion and have started to grow vertical, while sprawl is noted in villages in the periphery. Similarly, informal commercial areas have emerged since even the booths which are the smallest category of commercial establishments have been unaffordable. The Chandigarh Administration has been organising *mandis*¹ and *rehri*² markets adjoining the neighbourhood commercial centres. Over a period of time, different areas of the city have also been allotted on temporary basis to meet exigencies /or address the new requirements till such time proper arrangements for the same are made.

The city had a population of 1,055,450 in 2011 (Census of India, 2011) and is estimated to be 1,169,000 in 2021 (Census2011.co.in, 2021). The city has been experiencing a declining decadal growth rate. In 2011-2021 (Refer Table 1), it is expected to grow at about 11 percent which is slightly lower than the national decadal growth rate of 12.5 percent for the same period (The Wire, 2020). However, when compared to the population growth in the metropolitan cities which has been 3.8 percent annually during 2001-2011, Chandigarh has experienced much less growth that of 1.71 percent (Haque and Patel, 2017).

Table 1 Population Growth 1951 -2021, Chandigarh

Year	Population	Growth Rate
1951	24,261	-
1961	119,881	394.13
1971	257,251	114.59
1981	451,610	75.55
1991	642,015	42.16
2001	900,635	40.28
2011	1,055,450	17.19
2021 ³	1,169,000	10.76

Source: Census of India, 2011 and Chandigarh Administration, 2016

The city had been planned for a population of half a million and was developed in two phases. Sectors (1-30) developed in first phase consisted of low density (about 40 persons per hectare) spread over 3,642 hectares (36.42 Sq. Kms) consisting of 0.15 million population and the ones (sectors 31-47) developed in phase two were to accommodate a population of 0.35 million in an area of 2,428 hectares (24.28 Sq. Kms). The city after this development would have a cumulative density of 82 persons per hectare.

The city is today spread over 114 Sq. Kms having a density of 93 persons per Sq. Kms (2011) and 103 persons per Sq. Kms (2021). As per the Urban and Regional Development Plan Formulation and Implementation (URDPFI) Guidelines (Government of India, 2014), Chandigarh is a metropolitan city, considering its population being above one million as per 2011 Census. The guidelines suggest a density in the range of 125-175 per persons hectare for such settlements.

¹ Mandi means a temporary or permanent marketplace where food and agricultural commodities are sold.

² Rehri means street vending cart.

³ Projected population as per Censuses of India, the Census 2021 could not be conducted yet due to COVID19 restrictions.

The area of the Municipal Corporation is 79.74 sq. km out of 114 sq. km (Municipal Corporation of Chandigarh, 2018). The existing land use (including the extension areas of the city), about 38 percent of area is categorized as residential and 5 percent as commercial and a significant 8 percent each is assigned towards forests. On the other hand, the proportion of public and semi-public use land constitutes 11 percent and transportation land constitutes only 7 percent of the total area (Refer Table 2).

Tabel 2 Comparison of Land Use Classification of Chandigarh with URDPFI Guidelines

Land Use Classification	Existing 2014		Proposed 2031	URDPFI Norms
	Area in Ha	Percent	Percent	Percent
Residential	43.19	37.88	43.98	36-38
Commercial	5.42	4.76	5.99	5-6
Transport	9.56	8.39	9.77	12-14
Industrial/IT Park	5.37	4.71	6.52	7-8
Public/Semi Public	13.24	11.61	15.24	10-12
Recreational	9.83	8.62	11.41	14-16
Agricultural	0.00	0.00	2.72	Balance
Vacant Land	12.48	10.94	0.39	
Forest	8.56	7.50	10.38	
Defence	6.37	5.58	6.37	
Reserved	-	-	1.25	
Total	114.00		114.00	

Source: Chandigarh Administration, 2016 and Government of India, 2014.

The land allocated to the residential and public/semi-public use is above the given norms for the city of this type, which is an indication of its steadily increasing density. Further the area under transport and recreation is below the defined norms which shows the increase in stress on the city in ways as increasing traffic congestion and now a nearly annual water logging incidence during monsoons and impacts the well-being of the people.

The area under commercial use is within the stipulated range. The distribution of the commercial spaces exists in the city in a hierarchical form, which shops for basic amenities at the neighbourhood level. However, the commercial spaces are not to be not very well distributed in the higher density sectors. Further, there is a concentration of shops along the V2 and V3, which have been noted to have emerged as hotspots for the spread for COVID19. In the past decade, the emergence of concept of malls, has resulted in the traditional shopping complexes and plazas losing their importance, which had more open spaces and had grown into centres of various cultural activities as well. Other than this, in response to the demand of the residents, *apni mandi*⁴ have emerged and are potential hot spots for the spread of highly contagious diseases.

2.3. Green Spaces in the City

The initial plan by Le Corbusier had provision for large open spaces, green belts, city parks and neighbourhood parks in Chandigarh right from the beginning. There exists well-structured order in the hierarchy of open spaces in the city ranging from the neighbourhood level to the city level. The major principle which guided the formulation of Chandigarh's landscape design was that its original topography must be retained and integrated (Chandigarh Administration, 2016). Provision of green spaces in each sector and their interconnectedness with each other was basically meant to function as lungs of the city

⁴ Local farmers' market

and were for cultural and leisure activities of the neighbourhood population. Unlike other Indian cities the green areas in the Chandigarh city are planned within each neighbourhood.

The City's green identity has been established through its long-clear-cut vistas created in the first phase of the city connecting the residents to the skyline of the hills through continuous green spaces such as sector greens, Leisure Valley and Sukhna Lake promenade. Tree plantation and landscaping have been integral part of the city's Master plan. Green spaces are in the form of lawns private housing, open spaces in schools, colleges and other institutional large campuses such as Punjab Engineering College, Panjab University and Post Graduate Institute of Medical Education and Research (PGI). There are planned green areas at the city level which contribute as much to the overall city greenery.

The city does not have any incidental or random left-over open spaces but has well planned orderly hierarchy of green spaces. It is recognised by the city's administration that not only are these spaces to be protected in the future due to rapid densification of the city, but the green heritage of the city is to be nurtured. This has been reinforced through the lower level plans of group housing, which mandates 15 percent of community open spaces within campuses to maintain closeness with nature and for outdoor activities (Chandigarh Administration, 2016).

Urban green space in Chandigarh's Master Plan is a component of 'green infrastructure', that comprises of all urban land covered by vegetation of any kind. This covers vegetation on private and public grounds, irrespective of size and function, and include small water bodies such as ponds, lakes or streams known as the 'blue spaces' (WHO, 2017).

The Master Plan has adopted the urban development URDPFI Guidelines (Government of India, 2015) norms for open spaces ranging between 10 to 12 square meter per person comprising of parks, play fields, specified parks, amusement parks, maidans, multi-purpose open spaces, botanical garden, geological park and traffic park. The city has a well-planned tree plantation system, along its varied hierarchy of roads and open spaces which has been preserved in the older sectors and is being extended to the new sectors, which adds to the overall benefits that can be accrued from the green spaces in an urban area by its residents.

It must be noted that after the first phase of development, the city had 19.69 percent area under greens spaces (Chandigarh Administration, 2016). In 2001, average green spaces available was 17 square meters per person which is projected to be at 10.7 square meters per person by 2031 as per the Master Plan of 2031. The City's green cover rose from 21 per cent in 1991, 29.3 in 2003 to 35.7 in 2007 to 41 in 2017 and 46 percent in 2019 as per Forest Survey of India's Report 2007 and 2019. The per capita green space availability in the city presently is around 54.45 sq. meters which is better than most of the European cities (Chaudhry et. al., 2011), which includes the forested area around Sukhna Lake.

3. COVID19's spread in India

In India, the first case of COVID19 was reported on 30 January 2020 in a town in Kerala state. Subsequent spread led to announcement of lockdowns in Kerala on 23 March, and in the rest of the country on 25 March. Recoveries from COVID19 started exceeded the active cases for the first time in June 2020 and by September the infection rates started to drop along with the number of new and active cases. However, the daily cases peaked again in mid-September with over 90,000 cases reported per-day. There was steady decline since with cases dropping to about 10,000 in beginning of March 2021. A second wave began in mid-March 2021 which was much more devastating than the first, with shortages of hospital beds, oxygen cylinders and other medical supplies in many parts of the country. By late April, India had the highest number of new and active cases in the world. On 30 April 2021, it became the first country to report over 400,000 new cases in a 24-hour period. Since June 2021, the daily new cases have been below 50,000 and have a declining trend. Experts stated that the virus may reach an endemic stage in

India rather than completely disappear; in late August 2021, Soumya Swaminathan said India may be in some stage of endemicity where the country learns to live with the virus (BBC.com, 2021).

Sudden spike in the cases have been attributed to multiple factors including the highly infectious variants, poorly implemented regulations during the various unlock phases, and lack of preparation of health infrastructure for any future increase in COVID19 cases. Further, the economic slowdown pressurised the government to lift the restrictions.

India having a total population of 1366.42 million has had 34 million cases and 0.45 million deaths till the beginning of October 2021 which accounts for 330.66 deaths per million population and fares better than most developed countries like USA, UK, Canada, Russia, The Netherlands, Denmark, and Germany (Statista.com, 2021).

4. COVID19 in Chandigarh

The pandemic spread to various states and union territories of the country including the union territory of Chandigarh. The first case of COVID19 was recorded on 19 March 2020 (Chdcovid19.in, 2021). In the initial three months the cases were at a phenomenal rate of 300 percent. The spread was controlled due to strict implementation of lockdown resulting in decline in the number of cases in June. On 1st June 2020, government started to unlock in a phased manner. The unlock, however, led to an exponential in the cases which peaked in September 2020.

The lockdown during this period became more spatially focused into micro zones. Containment zones were identified where movement remained curtailed. Activities and movement were permitted only in areas outside the containment zones. Further restrictions during the festival season in October and November helped in controlling the spread of the virus as the increase in cases stagnated, with total confirmed cases hovering around 2,500 per month. The city experienced a steep decline in the cases in the beginning of 2021 due to strict measures adopted during the end of 2020, as all schools and colleges/universities continued to function in an online mode, and people too continued to work from home. Only activities related to essential services were opened during this period. With the cases declining, the movement of people was eased not only within the city but from other states and cities as well, which again led to another very steep spike in March, April and May 2021. The country and the city went into another phase of lockdown, with stringent imposition of restriction in containment zones. The spread of infection of COVID19 was controlled, however, it did impact a large proportion of the population. Vaccination campaign by the government has been able to control the spread and intensity of infections. The cases have declined since with about 100-150 cases per month since the last peak (Refer Table 3 and Figure 1).

The spatial spread of COVID19 was correlated with population density at sector level. In the city the density ranges up to about 1,100 persons per hectare. Current density of the city is 103 persons per hectare (Municipal Corporation of Chandigarh, 2021), while the city was planned for 60 persons per hectare. The sectors with high and very high densities have had the dominance of COVID19 cases. Sectors with low density have had COVID19 cases as well but the distribution shows a lower concentration of cases (Ref Figure 2).

Table 3 Monthwise COVID19 Confirmed and Deaths, Chandigarh

Month	Total Confirmed Cases	Percent Increase in Confirmed Cases	Total Deaths	Deaths per million population
March-2020	16		0	0.00
April-2020	58	263	0	0.00
May-2020	219	278	4	3.42
June-2020	147	-33	2	1.71
July-2020	611	316	9	7.70
August-2020	3,295	439	41	35.07
September-2020	7,592	130	106	90.68
October-2020	2,480	-67	64	54.75
November-2020	2,754	11	49	41.92
December-2020	2,051	-26	51	43.63
January-2021	890	-57	17	14.54
February-2021	825	-7	17	14.54
March-2021	4,863	489	29	24.81
April-2021	12,671	161	74	63.30
May-2021	17,399	37	278	237.81
June-2021	1,417	-92	58	49.62
July-2021	148	-90	1	0.86
August-2021	101	-32	6	5.13

Source: Chdcovid19.in, 2021

Figure 1 Figure 1 Monthwise COVID19 Confirmed Cases, Chandigarh

Source: Chdcovid19.in, 2021

Figure 2 Spatial Distribution of COVID19 from March 2020 to August 2021, Chandigarh

Source: Chdcovid19.in, 2021

The mortality rate in Chandigarh (0.07) is in the range of the states like Kerala and Maharashtra that have been on the forefront of COVID19 infections in the country. The fatality rate in the City has been in the range of the national figures and higher than one of the states having the highest infection (Kerala), which is indicative of the spatial distribution and quality of health infrastructure. This aspect may require a deeper investigation on aspects as comorbidity related deaths or referral to hospitals in Chandigarh from adjoining cities of Mohali and Panchkula (Refer Table 4).

Table 4 Fatality⁵ and Mortality⁶ Rates by (selected) States, India

	Chandigarh	Punjab	Haryana	Maharashtra	Kerala	Delhi	India
Fatality rate	1.24	2.75	1.28	2.12	0.54	1.74	1.33
Mortality rate	0.07	0.05	0.03	0.11	0.07	0.13	0.03
Mortality per million population	689.48	538.11	337.00	727.10	727.10	1280.00	321.50

⁵ proportion of deaths from a certain disease compared to the total number of people diagnosed with the disease for a particular period (NewsLit.org, 2021).

⁶ proportion of deaths from a certain disease compared to the total population for a particular period (NewsLit.org, 2021).

Source: Chdcovid19.in, 2021 and Mygov.in, 2021

The distribution of higher order facilities specially that can cater to emergencies like a pandemic need to be augmented in Chandigarh. The city has 32 dispensaries, 23 nursing homes and 4 hospitals. As per the norms of URDPFI Guidelines, this health infrastructure is more than adequate for the population size of Chandigarh. However, here a point to be noted is the spatial distribution of the health infrastructure, which is visibly concentrated in the middle and higher density sectors. In times of pandemic, the hospitals and nursing homes are more equipped to handle the complexities, while at the same time measures are required to upgrade the capabilities of dispensaries to function as backup centres in emergencies.

Chandigarh has two cities in its immediate vicinity, together popularly known as Tricity, which have had high dependency for facilities including health infrastructure till recent years. Though Chandigarh is a union territory governed by the central government and not a part of the neighbouring states of Punjab, Haryana, and Himachal Pradesh; it has developed into a vibrant and an important region. The Tricity, having an estimated population of 1.54 million and its region that of 2.1 million (Census of India, 2011), it is pertinent that a regional planning approach be adopted in future.

Chandigarh has been built on the concept of neighbourhood planning. This needs to be further strengthened by assuring the provision of core services at neighbourhood level, hence bringing in an approach of decentralisation.

5. Relation between COVID19 and Green Spaces

The first ever Town Planning Organisation (TPO) was established under the Ministry of Health in India (Government of India, 2021). The origins of town planning practice, particularly in India lie in ensuring health of residents (Geddes, 1918). Correlation between contagious diseases and density has not been researched upon much. Theoretically, dense areas lead to more interaction amongst people and are potential hotspots for spread of infectious diseases (Hamidi et.al., 2020). On the other hand, dense areas that are well planned have better facilities, though it may be difficult to impose social or physical distancing norms in such localities. Physical distancing is one of the measures adopted and imposed by the competent authorities to contain the spread of highly contagious diseases like COVID19. Poor sanitation conditions and non-availability of higher order health facilities is known to lead to more frequent and wider spread of such diseases.

Socio-cultural and demographic characteristics and inequalities further contribute to a faster spread of infectious diseases and worsens the situation by limiting the access to health care system, in turn increasing the mortality rates.

The most effective way to slow down the spread of highly infectious diseases is to minimize the human-to-human contact, by way of lockdowns, work from home and teaching-learning through an online mode. Such interventions are crucial to the containment of pandemics and its effectiveness can be brought in through integration of the approaches of the central, state and local governments, and awareness building and mass education through appropriate use of social media and traditional mediums of communication like radio and television.

The analysis of Chandigarh has significant implications on studying and combating other pandemics. Population density does have a correlation with the spread of COVID19. Therefore, population density is a variable for airborne infectious diseases. Mitigative measures in future epidemics caused by diseases like COVID19 should consider high density areas on a serious note.

The need for a viable mix of green and built spaces and more access to such spaces in the neighbourhoods needs to be of prime concern in future planning. During the pandemic and its various stages of lockdowns and unlocking, open spaces have become the only 'out of home' option. It had been

noted in an earlier study (Bedi et al., 2021) that during lockdown people had suffered from fatigue, depression, insomnia, and anxiety, besides physical disorders. Proximity to green open spaces had been instrumental in improving the well being of the people in the city. Though there was lesser possibility to access the neighbourhood parks during the initial months of the lockdown due to strict implementation of the norms, it was found that people did take to walking and exercising in the parks wither during the very early hours of morning or during late evening hours. With the easing of the restrictions, people were found to use the parks and open spaces while observing the required physical distancing norms.

6. Lessons for Urban Planners

The spread of epidemics has been closely related to the built environment since the 19th century (Rodger, 2019). The importance of designing a modern sewerage system was not realised until the cholera outbreak across the world. Similarly, plague transformed the laws of the cities. The design of buildings, including design for daylight, ventilation and sewer and drainpipes, contributes significantly to the control of infectious disease transmission in the built environment. The concerns over public health had prompted the planners of the 19th century like Patrick Geddes to put forth the vision of the regional city. He took Howard's idea of Garden City one step further by proposing regional planning as the answer to the congested large metropolis (Dudl and Sanchez, 1999). Further, Geddes maintained that each sub-region would be developed with the principles of ecological balance and resource renewal in mind. These principles still need to be the basis of today's smart city and real estate driven planning.

The objective needs to be not to create alternative built forms, but on a society founded upon participatory approach and mutual cooperation. The ideas of the 19th century visionaries align with the present day requirement of promoting health for all and sustainable development. Basing the learning in these principles and the spatial analysis of corelation between the incidence of COVID19 cases with parameters as population density, distribution of health infrastructure, location of very high population concentration and areas of high activity, some lessons have been derived which will be helpful for the urban planners in the near future.

Chandigarh, though developed with the vision of creating a primate city in the region, having socio-cultural and economic linkages with its periphery, has emerged into a metropolitan city with three towns of up to 0.2 million population each within a 40-minute driving distance. The dependency of these smaller settlements on the city for facilities is an indication on the need for **adopting a hierarchical and integrated regional planning approach** which needs to address the economic, social, health, transport, and energy planning of the whole region to reduce the adverse impact of epidemics.

Chandigarh is undoubtedly amongst the greenest cities in the country having a hierarchical distribution of green spaces as well as avenues and boulevards. It has been noted that, this distribution of green spaces is not uniform across the sectors, specially in the sectors that were developed in the third phase which are also the ones that have higher density. Efforts are required towards creating the green spaces and integrating it with the water bodies to make it a comprehensive network of blue-green spaces in the city. It would be advisable to adopt a bottoms-up approach, starting at the lowest level in the hierarchy to fill the gaps and build the city's resilience.

Chandigarh has been planned based on the neighbourhood concept, sector being the smallest unit. The Plan intended to make each sector independent of others in terms of basic services. However, over the years of development, many specialised markets have emerged in the city, refuting in some instances the basic purpose of the neighbourhood planning concept. This is the case with the provision of basic health services as well, which has over time got concentrated in certain sectors. As planners and administrative implementors of the development plans, actions are required to be taken to maintain the essence of the basic plans for the larger benefit of the residents.

Lastly, in this age of data driven cities, it is pertinent that the granularity of data be maintained by creating a strong digital infrastructure through the integration of public and private sectors at the local level. Such initiatives can be beneficial for the administration in times of not only epidemics but managing other disasters as well.

7. Conclusions

Historically, epidemics have always been key in shaping the urban environment. Cities are areas of concentration, and it is due to the concentration of population and activities that these places thrive. Concentration of population is a known cause of spread of infectious diseases, and this correlation has been spatially established in the case of Chandigarh. The required measure by the competent authorities is to ensure the provision of the basic services to the people irrespective of density, while at the same time ensure a balanced distributions of green spaces as these will be the pockets essential for the well-being of the citizens in future, in case of similar pandemic like situations.

The COVID19 pandemic has showcased non-traditional ways of work and life, in terms of online modes and work from home, which may lead the way in near future in revision of the land use, density and space norms of the urban settlements.

8. References

1. Chandigarh Administration, 2016, Chandigarh Master Plan 2031, Chandigarh.
2. Census of India, 2011, District Census Handbook: Village and Town Directory - Chandigarh, Government of India.
3. Census2011.co.in, 2021, Chandigarh Population 2011-2021 accessed at <https://www.census2011.co.in/census/state/chandigarh.html> on 15 August 2021.
4. The Wire, 2020, India's population will be 1.52 billion by 2036, with 70% of increase in urban areas, accessed at <https://thewire.in/government/india-population-growth-government-report-2036-projections-urban-migration> on 16 June 2021.
5. Haque, Ismail and Patel, Priyanka, 2017, Growth of metro cities in India: trends, patterns and determinants, Urban Research & Practice, 11(4):1-40 accessed at https://www.researchgate.net/publication/317616960_Growth_of_Metro_Cities_in_India_Trends_Patterns_and_Determinants on 29 July 2021.
6. Government of India, 2014, Urban and Regional Development Plan Formulation and Implementation Guidelines, Ministry of Urban Development, Government of India, New Delhi.
7. Municipal Corporation of Chandigarh, 2018, Basic Information <http://mcchandigarh.gov.in/> accessed on 26 July 2021.
8. Chaudhry, Pradeep and Tewari, V. P. (2011) Urban Forestry in India: Development and Research Scenario, Interdisciplinary Environmental Review, Vol. 12, No. 1.
9. BBC.com, 2021, Covid-19: Is India entering endemic stage of coronavirus? accessed at <https://www.bbc.com/news/world-asia-india-58302480> on 01 September 2021.
10. Statista.com. 2021, Coronavirus (COVID-19) deaths worldwide per one million population as of October 20, 2021, by country, accessed <https://www.statista.com/statistics/1104709/coronavirus-deaths-worldwide-per-million-inhabitants/> on 01 October 2021.
11. Chdcovid19.in, 2021, Chandigarh's fight against COVID19, accessed at <http://chdcovid19.in/> on 02 October 2021.
12. Municipal Corporation of Chandigarh, 2021, Connections, consumption and population of the jurisdiction, M.C.C. (collected during secondary survey).
13. Mygov.in, 2021, Cases across India, accessed at <https://www.mygov.in/covid-19> on 04 October, 2021.

14. Hamidi, Shima, Sabouri, Sedegh and Ewing, Reid, 2020, Does density aggravate the COVID19 pandemic, early findings and lessons for planners, Journal of the American Planning Association accessed at <https://www.tandfonline.com/doi/full/10.1080/01944363.2020.1777891> 24 September 2021.
15. Newslit.org, 2021, Understanding COVID-19 Data: Case fatality rate vs mortality rate vs. risk of dying, accessed at <https://newslit.org/updates/case-fatality-rate-vs-mortality-rate/> on 16 September 2021.
16. Government of India, 2021, Reforms in Urban Planning Capacity in India, Niti Aayog accessed at <https://www.niti.gov.in/sites/default/files/2021-09/UrbanPlanningCapacity-in-India-16092021.pdf> on 15 September, 2021.
17. Geddes, 1918, Town Planning Towards City Development, Part 1, Reproduced by TNV Indore.
18. Bedi, P., Mahavir and Tripathi, N. G., 2021, Contribution of Planned Urban Green Spaces for Promoting Human Health, 56th ISOCARP World Planning Congress, Doha ISOCARP.
19. Rodger, Richard, 2019, Urban Public Health: A Historical Perspective, Urban Health, Oxford, NY.
20. Duhl, L. J. and Sanchez, A. K., 1999, Healthy cities and the city planning process: a background document on links between health and urban planning, European Health21 Target 13.