Probing the Relationship Between Pandemic and Urban Morphology

Understanding COVID-19 Outbreak in Akola and its Urban Dimensions

Deshmukh Vaishnavi

Abstract

Since November 2019, the world has been dealing with the danger posed by the COVID-19 outbreak. As on date, the ongoing COVID-19 pandemic had resulted in roughly 18.5 million confirmed cases and 40 million deaths worldwide. As a result, many researchers are striving to investigate the dynamics of the pandemic in urban areas in order to understand the impacts of COVID-19 on cities. Because of their high human density and economic activity, cities are generally held responsible for COVID-19 infections. Furthermore, metropolitan cities have received much interest, but small and medium towns with limited health facilities have been overlooked. Selecting Akola, a city that registered higher number of infections in the early period, aims to look at the relationship between the spread of COVID-19, the population density and the settlement pattern in case of small and medium towns using recorded infections from April 25, 2020 to September 28,2021. The study was conducted using a mixed method approach wherein through archival search and structured interviews it was found that pandemic spread is based on human contact which generated varying spreading patterns over the period of time. The analysis was done at three different levels namely the district level where the points of human contact were studied; at ward level wherein, it was attempted to attribute the cases of infection concentration and at three identified neighbourhood levels where the reasons for such human contact and identification of housing typology was done with the help of structured interviews. It is evident that the pandemic breakout is driven by connectivity rather than density because the more interconnected the places (whether compact or vast) in large urban regions are, the harder the pandemic hits such areas. These findings suggest that the spread of pandemic is not directly correlated with density and other morphological and geographical factors are responsible for human contact. the research is not a study on pandemic spread patterns but how the pandemic has given us the opportunity to probe the morphology of the city to learn the future structuring principles for urban design.

Keywords: COVID-19, population density, pandemic, medium towns, Akola

Introduction

The coronavirus has infected most nations to differing extents with a lot of variation in the distribution and severity of infection across and within countries. It has created significant disruption in the way people live and move in cities. The extremely infectious coronavirus disease (COVID-19) was discovered in Wuhan, China in December 2019 and has already spread to 212 nations and territories worldwide, affecting millions of people. The disease was first detected in India, a large country of around 1.3 billion people, on January 30, 2020, in a student returning from Wuhan. The global spread of COVID-19 has led to over 80 million infections worldwide by the end of 2020 (WHO, 2021). There are several unknown factors, but early discovered cases imply that coronavirus entered India via travellers, migrants, and tourists visiting international gateway cities Mumbai and Delhi from West Asia, Europe, and the United States. The airborne fast-transmitting virus began its spread to additional Indian towns and cities from these gateway cities. The density of large cities was a main magnet of virus carriers, resulting in virus spreading first inside cities and subsequently to other cities. Moreover, the rate is indicative that residents living in high population density regions, such as major or metropolitan cities, are more likely to come into close contact with others, and as a result, any contagious disease is predicted to spread quickly in dense places. Given that India has the world's second-densest population, a substandard healthcare system, and a high migration rate, along with the fact that 21.9 percent of the country's overall population lives below the poverty line, according to National Sample Survey Office statistics from 2018 (Rinju, 2020). The high densities and crowded living conditions of the cities, particularly in the developing countries such as India has been attributed to the infection’s rapid spread (Mishra, 2020). However, as time has passed, the infections have spread throughout India's various city sizes as well as to less susceptible areas of the city, raising numerous issues regarding the disease's epidemiology and control. Physical distance and self-quarantine remain far from being implemented in overcrowded areas, where the informal settlement is ill-prepared to battle the pandemic and has insufficient hygienic access. The virus (COVID-19) is known to spread by droplets emitted by an infected person when they talk, cough, or sneeze. This was verified early in the outbreak when virus particles were discovered in COVID-19 positive people, emphasising the importance of social (physical) distance to prevent the disease from spreading through person-to-person transmission. A single affected person is enough to trigger an exponential rate of spread, depending upon his / her contact rate and exposure time with susceptible people in the population (Bajpai, 2020). Therefore, to curb the rise of infections involved enforcing social distancing measures which included bans on non-essential travel, work from home orders, school closures and temporary shutdown of offices and businesses.

As coronavirus transmits via human contact, common perception is that Covid-19 spreads rapidly in dense areas whereas the probability is low in areas with less population density. The analysis indicates a positive correlation between Covid 19 infection and related mortality with population density. The (large) density in India is reflected through the pressing of people against each other in the street, public vehicles, trains, queue for ration, etc. The intricate link between "diseases and city" has long been debated: whether urbanisation and high-density urban forms accelerate disease transmission. Residents living in high population density regions, such as major or metropolitan cities, are more likely to come into close contact with others, and as a result, any contagious disease is predicted to spread quickly in dense places. Furthermore, metropolitan cities have received much interest, but small and medium towns with limited health facilities have been overlooked. Moreover, the influence of density on developing infectious diseases has received little attention. This paper focuses on the socio-spatial determinants of COVID diffusion by probing into the relation of population density and the spread of pandemic which happened over the period of time in case of Akola. Because the virus spreads by contact, the more the mobility (which is expected during relaxation of lockdown), the greater the contact, and the greater the risk of infection. The study is not about pandemic spread patterns, but about how the pandemic has allowed us to investigate the city's morphology in order to discover future structuring principles for urban design.

Literature Review

A review of literature study of urban studies found that some attribute density for the spread of coronavirus because it enhances the opportunity for person-to-person contact, which is an obvious reflection but fails to explain why COVID-19 occurrences differ among cities despite the same city-level densities (Bajpai, 2020). Density comes at the top of these constraints; calls poured in to abandon compact cities with high densities (Sharifi, 2020). On the other hand, some theorists demanded a return to compact cities to meet the daily needs, with lower densities and lower crowding rates (Hamidi S. S., 2020). Compact development has been empirically linked to higher economic productivity and likelihood of innovation generation which hosts the frequent face-to-face contacts (Hamidi S. Z., 2012). For the same reasons, dense areas could also facilitate the transmission of highly contagious diseases. If people are close enough to each other to exchange ideas, they can exchange highly contagious diseases, too, at least in theory (Glaeser, 2011). Dharavi, Asia's largest slum, located in Mumbai and home to about one million people which makes it one of the world's most densely populated regions, contradicts this statement (Rinju, 2020).

The H1N1 pandemic of 2009 persisted for a relatively longer period of time in areas in Taiwan with higher population density (Kao, 2012). In the same line, a positive and significant relationship between the death rate from the 1918 influenza pandemic and the state-level population density in the United States (Garrett, 2010). On the other hand, there is no significant relationship between population density, degree of transmissibility, and mortality during the same 1918 pandemic in the United Kingdom and Japan, respectively (Nishiura, 2008), (Chowell, 2008). There are no significant associations between mortality rate and population density during the 1918 influenza pandemic in 45 large U.S. cities (Mills, 2004). In an editorial piece in the *American Journal of*

Public Health, it argues that if we look at the rates rather than counts during the 1918 pandemic, rural/low-density areas were hit harder than the cities with lower mortality rates (Parmet, 2018). The virus has often been debated as being airborne, with higher risks of dissemination under situations such as inadequate ventilation, overcrowding, or if physical contact increases as a result of returning to regular activities. A study of the relationship between the reported number of COVID-19 impacted patients per thousand persons in Indian cities larger than 500,000 people and their population densities as of May 4, 2020, found that city density had no effect on viral infection rates implying that density appears to be a scapegoat rather than the root cause of increased viral transmission at the city level (Bajpai, 2020).

Research Questions

This viewpoint represents three research questions and argues that spread of pandemic is not directly correlated with density and other morphological and geographical factors are responsible for human contact.

1. What is the pattern of Corona virus spread in small and medium-sized towns?
2. What is the relationship between corona virus and urban morphology?
3. How do the socio-spatial drivers of COVID-19 dispersion, such as population and settlement, influence the propagation of the pandemic?

Methodology

The virus's spread in India has multiple routes and that the spread of pandemic is not directly correlated with population density. Despite concerns that the pandemic would impede momentum for compact cities, smart growth, and density in general, it has been difficult to anticipate the pandemic's impact since the link between hygiene concerns and density perceptions is poorly understood and therefore has undergone little research. Selecting Akola, a city that registered higher number of infections in the early period, aims to look at the relationship between the spread of COVID-19, the population density and the settlement pattern in case of small and medium towns using recorded infections from April 25, 2020 to September 28,2021. Akola, one the worst hit district right from the first wave in Maharashtra had the highest number of COVID-19 deaths in Vidarbha (Deshpande, 2020).

Infections that have been reported are utilised as data since the claimed number of illnesses is based on those who were tested, self-reported, and identified using a thermal scanner. The data collected and analysed is for Akola city, administered by the Akola Municipal Corporation, divided into four zones comprising of a total of 71 wards. As per the Census India 2011, Akola city has population of 4.2 L. For monitoring the COVID-19 infections, the zone office compiled data for each of 71 wards. The study was done based on mixed method approach to understand the correlation between spread of COVID-19, population density in response to the settlement pattern. Data collection, mapping was done through archival search which helped in understanding the correlation.

Structured interviews with the healthcare officials were done to understand the factors responsible for the uneven spread of coronavirus at city level. Moreover, the structured interviews with the local residents were conducted who were belonged to varying service sector. The analysis was done at three different levels namely the district level where the points of human contact were studied; at ward level wherein, it was attempted to attribute the cases of infection concentration and at three identified neighbourhood levels where the reasons for such human contact and identification of housing typology was done with the help of structured interviews. The data of the infected when aggregated at ward level allowed the understanding of its correlation with population density which is available from April 25, 2020 to September 29, 2021.

Results and Discussion

Akola was subjected to various levels of lockdown in accordance with national restrictions from March 24 until April 14, 2020.The second occurred from April 15 to May 3, 2020, when restrictions were enforced in the city's central, eastern, and southern areas although mobility was allowed to reach essential necessities such as food stores, fruit and vegetable stands, and medications in other areas. As the infections advanced, a third lockdown was implemented from May 4 to May 17, 2020, which was the toughest of all, prohibiting the delivery of any perishable food products. The fourth was from May 18 to May 31, 2020, which was more flexible in the city but strict in high-incidence areas. After May 31, 2020, certain areas, known as containment zones, continued to be restricted, while the majority of the city reopened to normal activity with limited office operations. The four unlocking phases which started from (1-30 June), (1-31 July), (1-31 August) and (1-30 September) 2020 too enabled mobility and hence increasing contacts, the containment regions have altered in response to the growth in infections, and so the cases of infection has varied through time.

Two data sets have been used; one that contained the date wise infection cases over the period of time along with the address of the individuals which helped in gaining understanding about the location and its correlation with the urban morphology and population density. The second data is obtained by conducting structured interviews from three identified neighbourhoods, namely, Old City, Sindhi Colony and the Choti Umari which vary in terms of population density as well as the infected cases. This data allowed in observing geographic and economic characteristics and the reasons that facilitated human contact. These data when aggregated at neighbourhood level allowed in correlating variables of housing typology and crowding. The population distribution is more concentrated into (South Zone) SZ, followed by (North Zone) NZ and (West Zone) WZ mostly along the city boundary. However, the population density into each of these zones is less compared to the core city area.

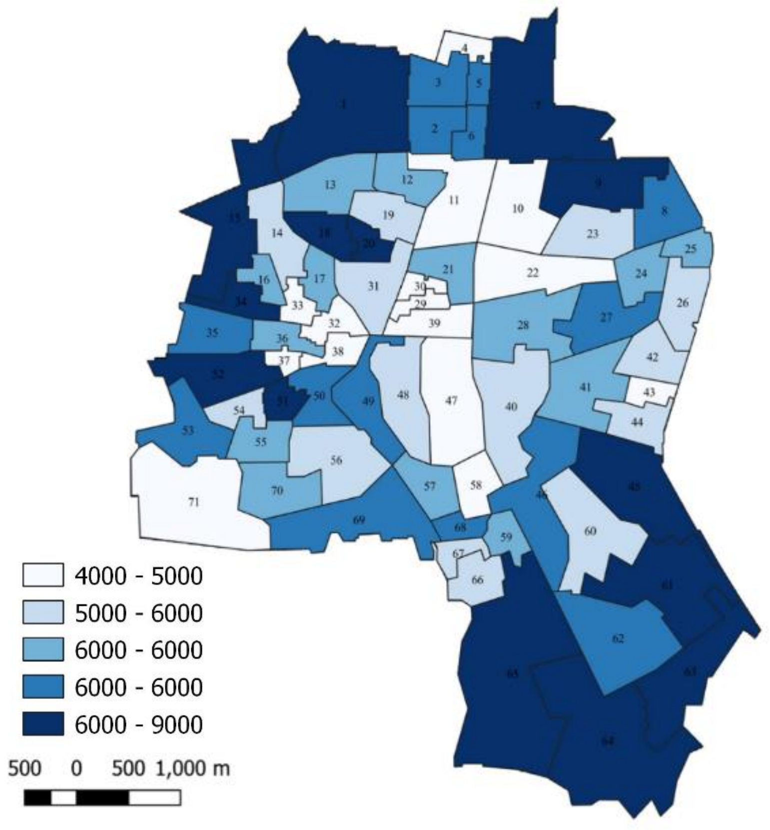

Figure 1: Ward Wise Population Distribution

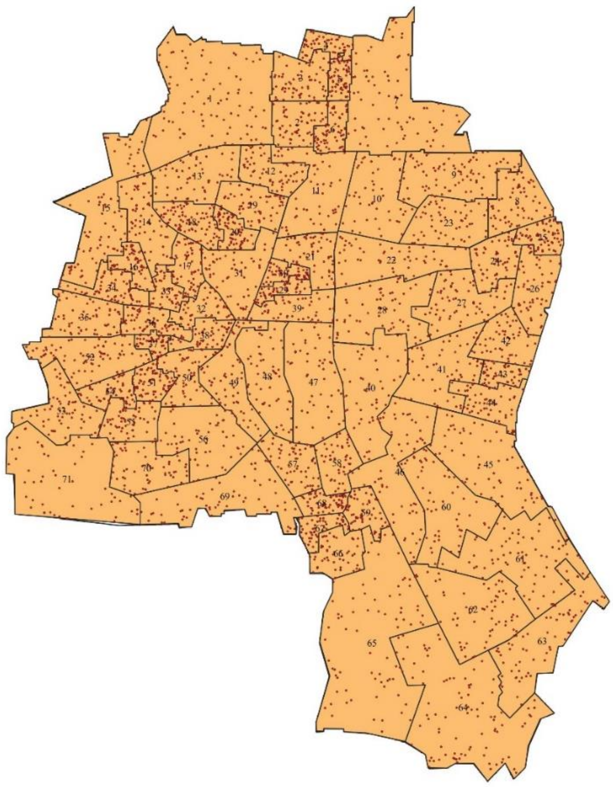

Figure 2: Ward Wise Population Density Distribution

Moreover, the population distribution into the core city area ranging from 4,000-7000 is seen while into the peripheral wards it ranges from 7000-9000. Similarly, the density distribution is highly concentrated into the south zone with minimum essentials available for which a dependency was seen on other parts of city. For the Southern Zone, the density distribution is quite sparse compared to the Eastern and the North Zone.

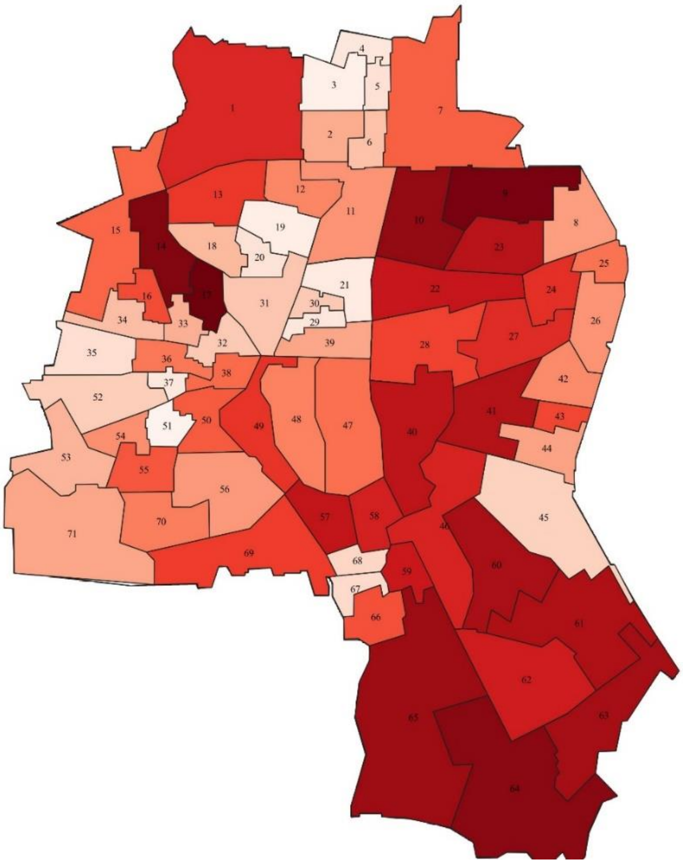

Figure 1: Ward Wise Infected Cases

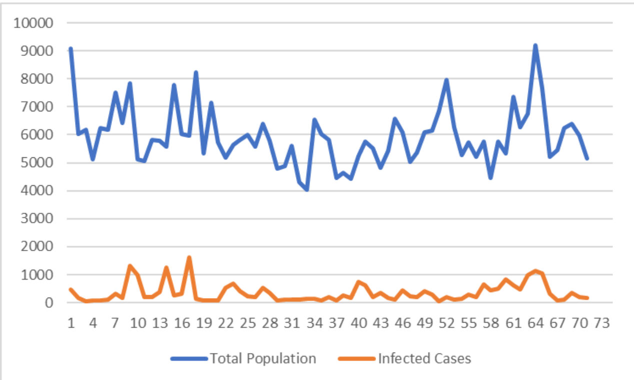

Figure 4: Relation Between Total Population and Infected Cases

The data collected regarding ward wise infected cases distribution gives a clear understanding regarding the correlation between pandemic spread and population density. During the entire period, 24,311 infected cases were reported with 710 death cases. The spread of infections appears to have happened owing to greater interaction due to increased movement of individuals when the lockdown was loosened in certain sections of the city, primarily the western portion of the city, which has high density. South Zone which is more likely to have a sparse density distribution is seen to have a greater number of infected persons compared to the Western Zone. Similarity could be seen into the North Zone where a direct correlation with the infected cases is not established. Despite having moderate density distribution in the Eastern zone compared to the Western Zone cases of infected population were more. Therefore, it could be established that population density and spread of pandemic is not a straight line.

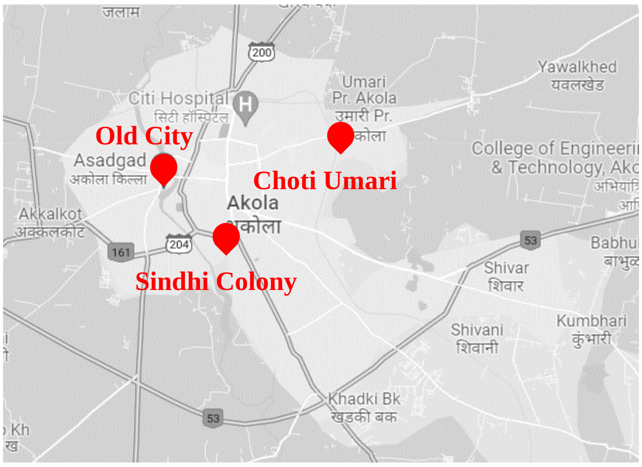

Figure 5: Identified Neighbourhoods

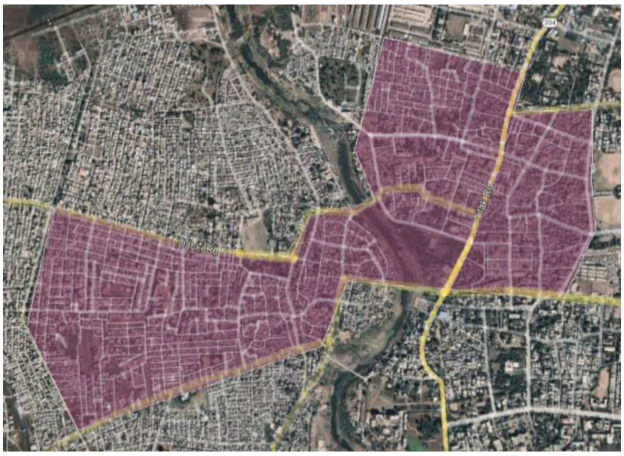

Figure 7: Old City (Neighbourhood 2)

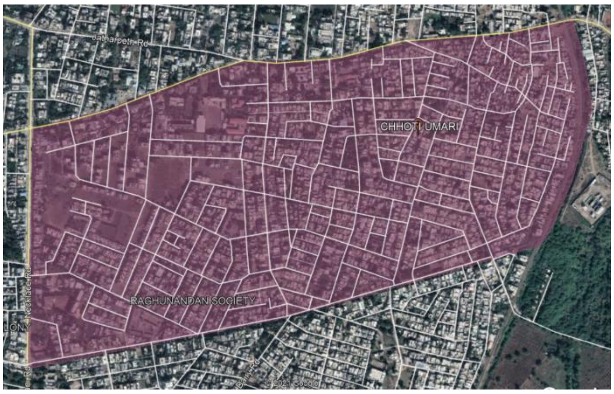

Figure 6: Sindhi Colony (Neighbourhood 1)

Figure 8: Choti Umari (Neighbourhood 3)

To investigate further, three identified neighbourhoods were studied. Sindhi Colony, Old City, and Choti Umari are located in the SZ, WZ, and EZ zones, respectively. Structured interviews were done with interviewees ranging in age from 25 to 70 years old and working in a multitude of sectors. On October 17, 2020, an interview was held in Sindhi Colony (Neighbourhood 1) for residents of Kacchi Kholi and Pakki Kholi who were generally engaged in commercial activities and whose workplace locations were mostly in the same neighbourhood. Choti Umari (Neighbourhood 2), on the other hand, worked in the private sector and had workplace locations outside the neighbourhood, implying a necessity to commute outside. Similary, work places of the interviees of Old City (Neighbourhood 3) were located outside the neighbourhood. 12 out of 18 interviwees were therefore working actively. Though the employment status has changed since the lockdown was announced with reduced working hours yet it shows their engagement with other people which increased the chances of human- to human contact. Data regarding the need to buy essentials like vegetables, grocery, milk, medicines and other items shows necessity on buying these essentials on everyday basis, weekly and monthly, where mostly need to buy essentials were on daily basis and weekly alongwith need to travel outside the respective neighbourhood. Therefore the major reasons for coming in more human contact were either the type of work they were involved in or the need to buy these essentials.

Another dimension which adds to this is the availability of amentities and the need to access those. Hospitals, General clinics, Banks any kind of religious places became an active source of human contact during the

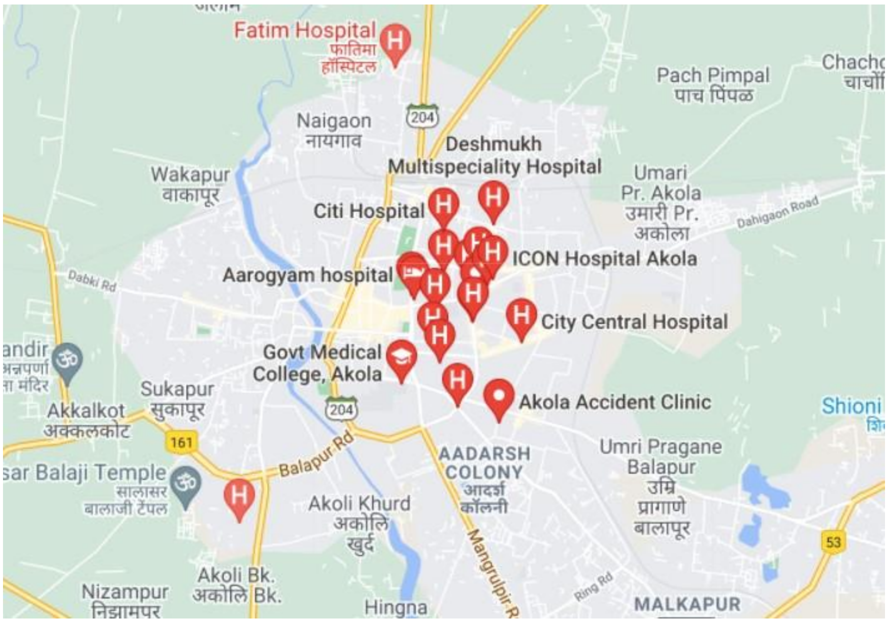

Figure 6: COVID Hospital Location

lockdown. 11 out of 18 interviewees accessed hospitals and general clinics either for being a symptomatic or routine checkups. Moreover, the location of COVID hospitals into the central city area accelerated the risk of infection spread as lack of such advanced facilities were lacking in Western Zone. General Clinics accessed by various age groups too facilitated human contact. Akola being a medium town still has a large population accessing banks frequently resulting in long queues and crowding which too was seen actively. 14 out 18 accessed banks monthly, 2 out of remaining accessed ATM's frequently within a period of fifteen days while the remaining 2 accessed banks once in every two months. Because COVID19 spreads by contact, people who are more mobile and move out of the house are more likely to become infected. Despite strict lockdown being announced in phases so as to cut the chances of mass gatherings, marriages, funerals, family get together were the reasons which facilitated movements across neighbourhoods. 14 out of 18 were involved in similar gathering resulting the spread.

To understand the socio spatial determinants, population, urban morphology dwelling type was considered. The data was aggregated to three neighbourhoods in the city. Sindhi Colony which is a gated community restricted people's movement into the area shows a moderate infection rate. Being engaged into commercial activities outside the neighbourhood increased the chances of infection over the period of time. Whereas, old city area, characterized by narrow lanes, compact attached housing contradicts the theory that such areas are more responsible of the spread of virus. Choti Umari and Sindhi Colony, low dense neighbourhood having plotted formal settlement pattern was seen to have the spread of infection to households that live in medium density. In Sindhi Colony area, 3 out of 6 reside in detached houses and remaining 3 into semi-detached houses yet marks high infection cases. 5 out of 6 reside in detached houses in Choti Umari still have moderate number of infected cases. Whereas, old city where 5 out of 6 interviewee reside in attached housing marks least number of positive cases.

Conclusion

The coronavirus (COVID-19) has been identified as the most significant public health concern since the 1918 influenza pandemic, and the effects of density on the COVID-19 pandemic are at the focus of the investigation. Goal of the paper was to probe the relationship between COVID-19 pandemic and the Urban Morphology in case of small and medium towns, specifically. For that purpose, the correlation of total infected cases, ward wise population distribution for a total of 71 wards were analysed first. Later at neighbourhood level different aspects like work place, employment pattern, housing typology were correlated and at zone level were points of human contact were studied. It is a general assumption that density is associated with higher rates of transmission, infection, and mortality from highly contagious diseases such as COVID-19 (Olsen, 2020), (Rosenthal, 2020). The data given on the association between density and COVID-19 infection and fatality rates in Akola indicates the inverse. Population density and the number of infected cases is not having a direct correlation and other aspects which increases the points of human contact are responsible for the pandemic spread. These findings imply that the pandemic breakout is driven by connectivity rather than density. Pandemics spread through the movement and interaction of people, and the majority of these movements and interactions take place in major city areas. The more interconnected the places (whether compact or vast) in large urban regions are, the harder the pandemic hits such areas. These findings suggest that future study should focus on the significance of connectedness vs density in pandemic transmission. The results of these analysis support the research presumption that the spread of pandemic is not directly correlated with density and other morphological and geographical factors are responsible for human contact and how it has given us the opportunity to probe the morphology of the city to learn the future structuring principles for urban design. The conclusion that density has little to do with proven viral infection rates is significant, unanticipated, and important. The role of urban designers and local governments in addressing pandemic outbreaks is critical, but not by advocating for low density, but by playing a key role in adopting measures tailored to their community for more effective implementation of social distancing measures and mitigating the negative impacts.

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