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Covid-19 Cases in Savar Upazila of Bangladesh: A Geographical Inquiry

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Abstract

Now present World is struggling unpresented event like Covid-19. It escalates almost all populated country (214, 09/10/20). Bangladesh also straining Covid-19 which is the second most affected country in Asia. The study area Savar Upazila is a fringe area of Dhaka city which is most affected Upazila. The study collected data from Upazila Health Complex. The aim of this study is to explore the detail data of Covid-19 cases in study area. The study denoted the Covid-19 cases in age-sex structure, affected Covid-19 cases by occupation-wise in pie chart, thematic dot map used for mapping the affected Covid-19 cases and Nearest Neighbor Index used for pattern analysis of Covid-19 cases in study area. The result of this research, working age group more affected than other groups, male is more affected than women, Worker people more affected than other occupations, it also unearthed Covid-19 affected cases reduces with distance and more populated area more affected in study area. It also reveals Covid-19 cases in study area is cluster pattern. ArcGIS, Google Earth Pro, Google Maps, SPSS and Microsoft Excel tools use to data gathering, data management and analysis. The study is very noteworthy for planning and management of Covid-19.

Keywords: Age-Sex Structure, Thematic dot map, Nearest Neighbor Index, Cluster Pattern, Covid-19.

1. Prelude

The present World is staggering the health emergency which the World Health Organization (WHO) has declared the corona virus disease (COVID-19) a pandemic (WHO, 2019). On 31 December 2019, a bunch of cases of pneumonia of unknown cause, in the city of Wuhan, Hubei province in China, was reported to the World Health Organization. In January 2020, a previously unknown new virus was identified (WHO, 2020), subsequently named the 2019 novel coronavirus, and Corona viruses got their name from the way that they look under a microscope. The virus consists of a core of genetic material surrounded by an envelope with protein spikes. This gives it the appearance of a crown. The word Corona means “crown” in Latin. Coronaviruses are zoonotic, meaning they are contagious between animals and people (Physiopedia, 2020).

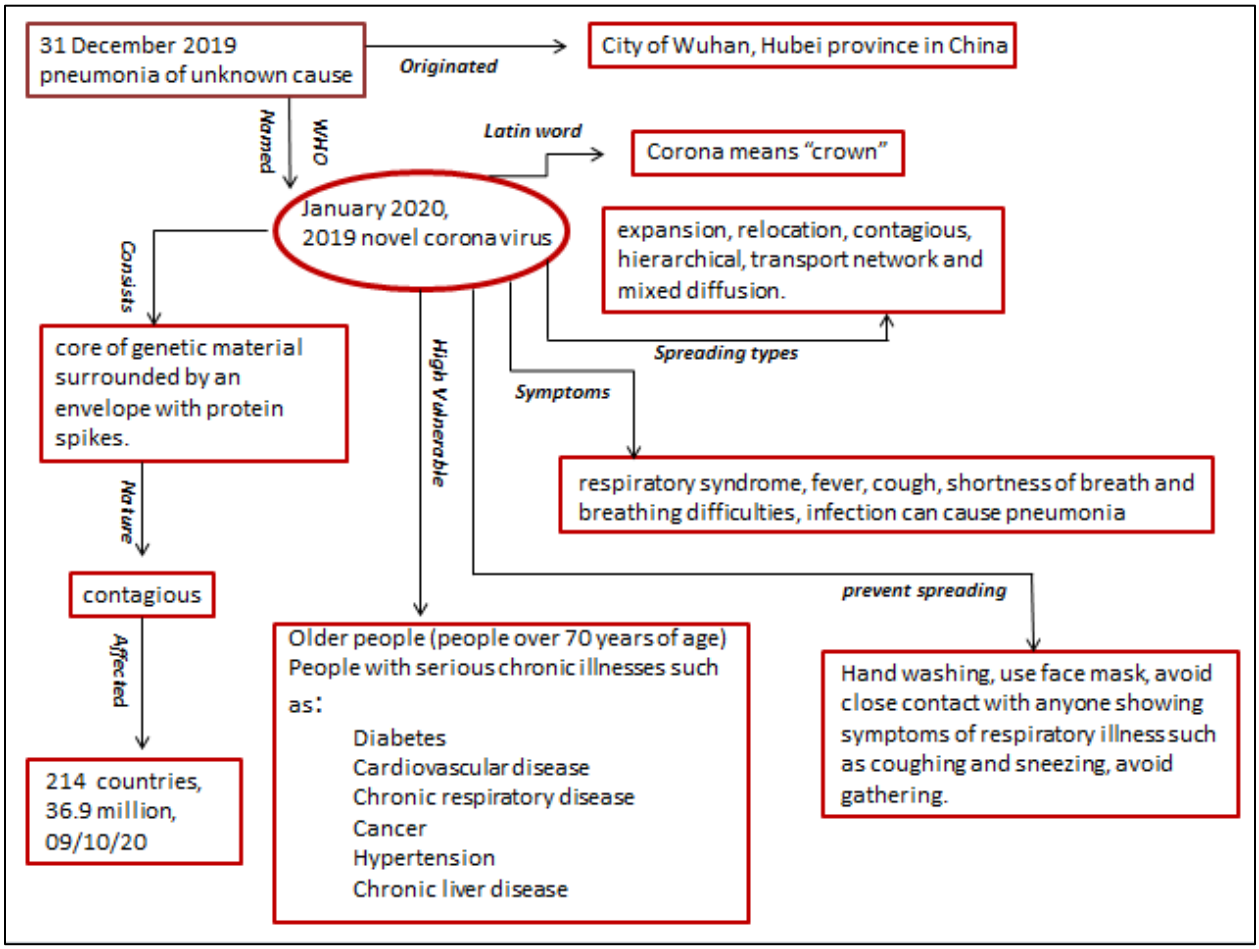
The virus spread rapidly and infectious diseases don’t stay put in the China’s Wuhan region. They tend to move and spread on the different places on earth. Coronaviruses are more mobile than previously others virus, because we are more mobile than before and carry diseases. Now our world is more interconnected than ever before in its history. The contagious disease like coronavirus may be spread in various way such as; expansion, relocation, contagious, hierarchical, transport network and mixed diffusion. Though the novel coronavirus was emergence Wuhan but it spread almost all over the world (214, countries, 09/10/20) through combination of these varieties (CNN, 2020; IEDCR, 2020).

The coronavirus was confirmed to have spread to Bangladesh in March 2020. The first three known cases were reported on 8 March 2020 by the country's Institute of Epidemiology, Disease Control and Research (IEDCR). They included two men that recently returned from Italy and a relative female (Reuters, 2020; Corona Info, 2020; IEDCR, 2020). Since then, the pandemic has spread day by day over the whole nation and the number of affected people has been increasing. Bangladesh is the second most affected country in South Asia, after India. On 18 March, Bangladesh reported its first coronavirus death. In whole country, 53% affected people in Dhaka district where 65% population affected in Dhaka City. Savar Upazila is a fringe area of Dhaka City which connected National and prominent Highway of Dhaka-Aricha (N5) Highway. Savar Upazila confirms its first coronavirus case was 14 April 2020 (Dhaka Tribiun, 2020).

The study is the investigate the Covid-19 situation in Savar Upazila of Dhaka district. The research data collected from Savar Upazila Health Complex. The study demonstrated in several ways such as map, age-sex structure of affected of Covid-19, pie chart of occupation-wise affected people, pattern analysis etc. which fulfilled with the techniques of Google Earth Pro, Google Maps, ArcGIS, Microsoft Excel and SPSS.

Savar Upazila also struggling with Covid-19 like whole world. The study area is familiar as an industrial region and Savar Paurashava is an over-populated area (SCRDP, 2019). It's now indispensable to investigate region-wise unpresented event like Covid-19. The research is important to portrait the Covid-19 situation as a case study of Bangladesh.

Figure-01: Summery of Covid-19



Sources: Complied by Authors, 2020.

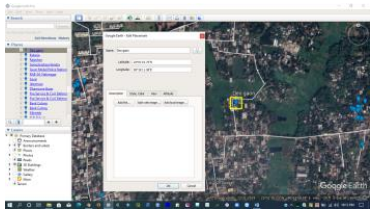
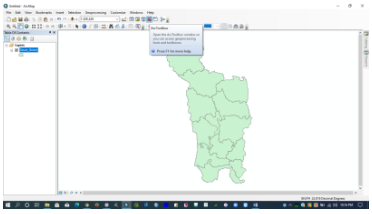
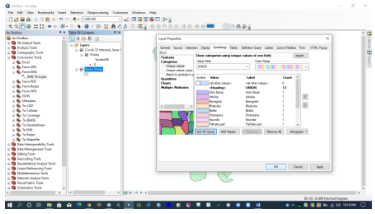
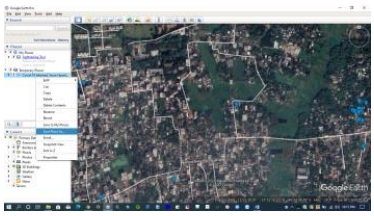
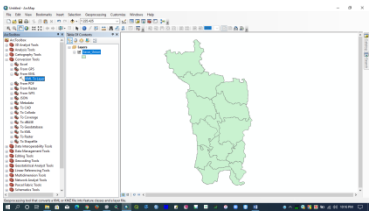
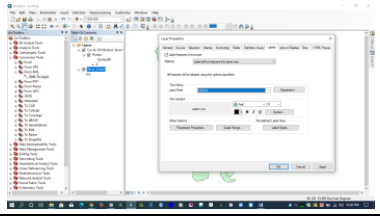
2. Methodology

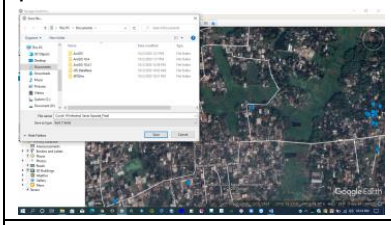
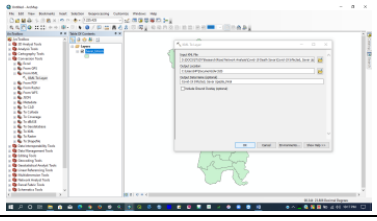
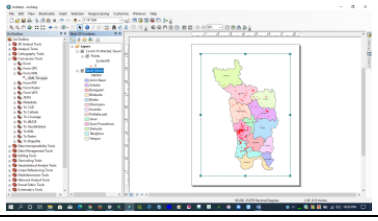
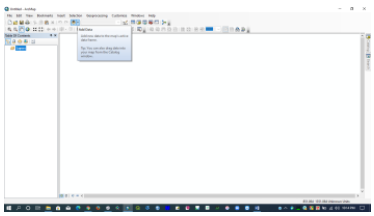
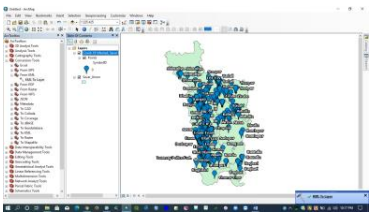
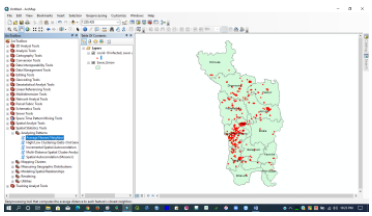
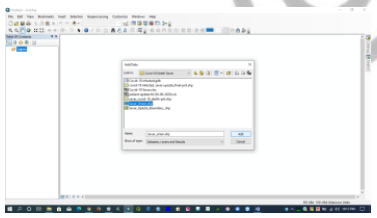
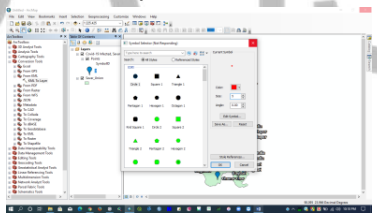
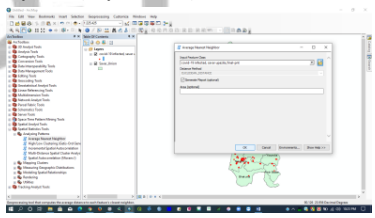
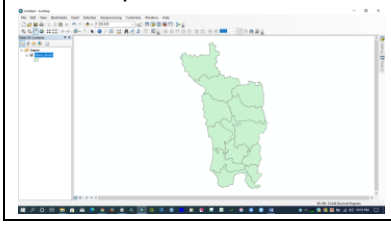
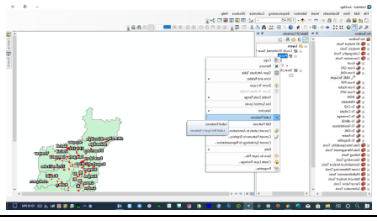
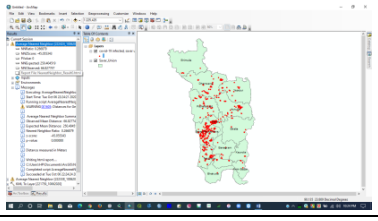
The research data has been collected from Savar Upazila Health Complex. SPSS and Microsoft Excel have been used for data store and management. ArcGIS 10.5 has been used for Nearest Neighbor Analysis. Data presented by age-sex pyramid, spatial distribution pattern diagram, pie chart, histogram and maps. Spatial distribution pattern has been vital representation of this research. Researchers developed point data for the Covid-19 affected peoples using Google Earth Pro and Google Maps. The information of the Covid-19 has been converted to spatial geo-database using ArcGIS tools. The spatial distribution of these

data has been shown in this study. The map reveals a spatial distributional pattern and general readers could easily make a mental frame of the distribution pattern of the Covid-19 of the study area. The Nearest Neighbor is a method of exploring pattern in the locational data by comparing graphically the observed distribution functions of event-to-event or random point-to-event nearest Neighbor distances, either with each other or with those that may be theoretically expected from various hypothesized models in particular that of spatial randomness (Maptrove, 2020). It's described the distribution of points according to their spacing. This analysis can be available in the spatial statistics tools in ArcMap. The values of NNI range between, 0 and 2.1491. When all the points in a pattern fall at the same location, the pattern represents the theoretical extreme of spatial concentration, in this case, Ad = 0 and NNI = 0. The more closely the points are clustered together, the closer to 0 NNI will be, since the average nearest Neighbor distance decreases. The closer NNI gets to 1, the more randomly spaced the points are. The value of NNI approaches 2.1491 for perfectly uniformly spaced points. Let the null hypothesis in the NNI-

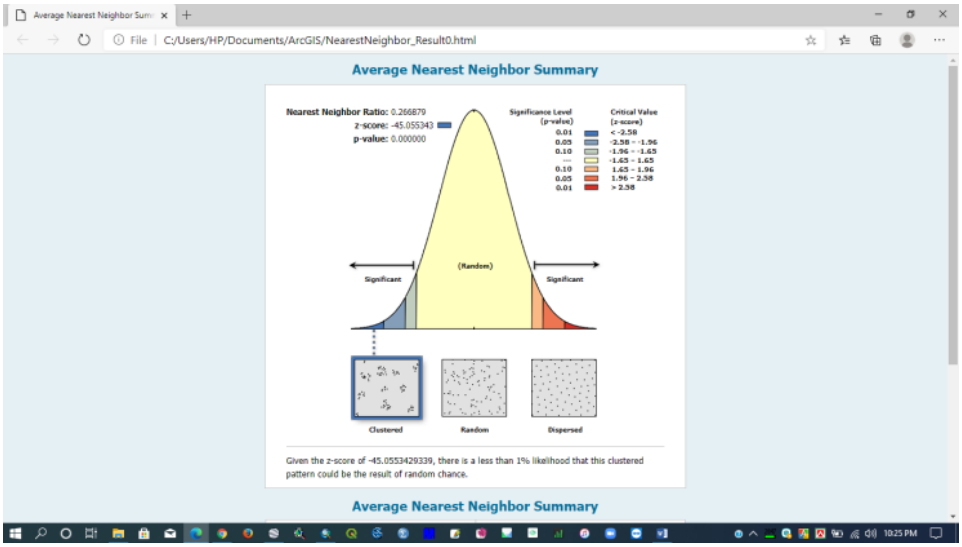
H^{o} = The distributional pattern of the Covid-19 affected peoples of Savar Upazila has no pattern and are the chance of random occurrences.

Table-01: Step by step data gathering and data analysis presented in below

Step-1: Open Google earth Pro and plotting the Covid-19 infected data. 	**Step-7:** Click on Arc Toolbox for Covid-19 Plotted data extraction on ArcGIS as shape file 	**Step-13:** Then symbolized file to go to symbology >>> categories >>>Add All Values 
Step-2: When the Covid-19 data plot competed, then right click on this plotted folder and click on >>>save place as for this file save to PC. 	**Step-8:** The Click on Arc Toolbox's for convert this file as a KML file to shape file for mapping tool>>> Conversion Tools>>> From KML>>> KML to Layer 	**Step-14:** Then Click on Labels option and tick on Label features in the layer, then selected the Label field, then It may modify Text Symbol and Finally click to OK option. 

Step-3: Then select file type as KML format and save the plotted data in a folder. 	**Step-9:** Then fill the KML to layer field and selected output folder then click to OK 	**Step-15:** Here showing the union wise Covid-19 Infected map on Savar Upazila. 
Step-4: Open ArcGIS and click on >>>Add data for added Savar Upazila Union wise Shape file for Covid-19 mapping. 	**Step-10:** Here showing the Extracted or converted Covid-19 data as point shape file (KML to Shape file) and Savar Upazila Union wise Shape file. 	**Step-16:** Added necessary file then go to Arc Toolbox>>> Spatial Statistics Tools>>> Analyzing Patterns>>> Average Nearest Neighbor 
Step-5: Then select the shape file that needed to open here for mapping and click on >>>Add 	**Step-11:** Then Click on Symbol for change the current symbol. Then select the needed symbol, color and size of Symbol 	**Step-17:** Fill and input the Covid-19 infected data, Select Distance method and tick to Generate Report (Optional) and click to OK 
Step-6: Here showing the added Savar Upazila Union wise Shape file 	**Step-12:** Right click on point shape file and Untick the Label Features option (If Needed). 	**Step-18:** To Show Current Session click on the Report File: NearestNeighbor_Result0.html 

Step-19: Here showing the Average Nearest Neighbor summary with graphical representation.

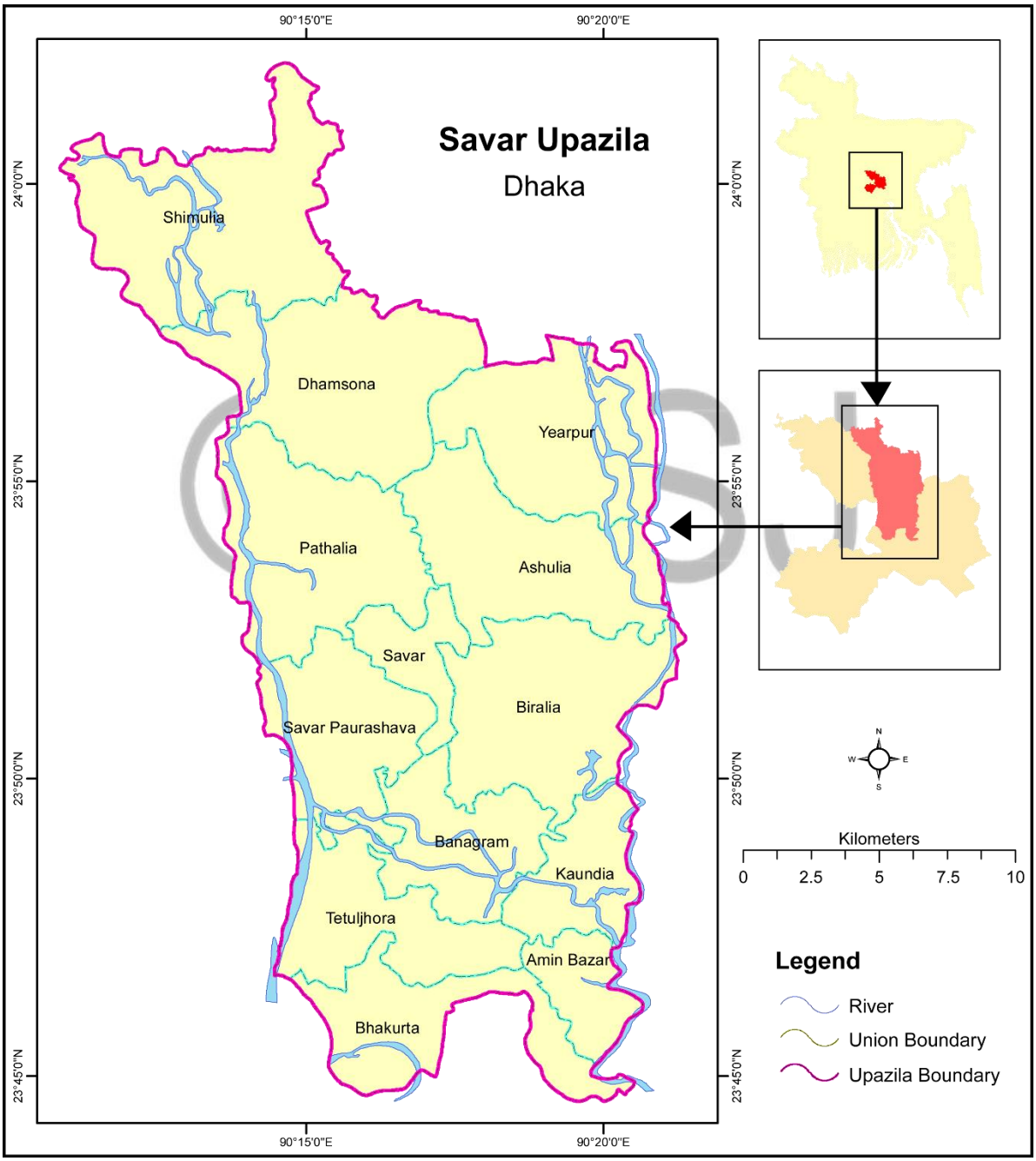


3. Study Area

Savar Upazila is geographically located between 23°44'and 24°02' north latitudes and in between 90°11' and 90°22' east longitudes. The Upazila occupies an area of 283 sq. km, including 20 sq. km of river and 8 sq. km of forested area (Huda, 2020). According to the Banglapedia 2015, the population of Savar Upazila was 587041. It has a rapidly growing population and has experienced a change in its traditional agrarian land use during the last few decades due to rapid urbanization and industrialization (Islam, 2015). Dhaka-Aricha highway is the main transit route of Dhaka which covers about 30 km in the Upazila. Its construction has triggered massive change of the landscape (SCRDP, 2020). Savar Upazila consists of Savar Paurashava and 12 other unions like Savar, Shimulia, Dhamsona, Yearpur, Ashulia, Birulia, Bhakurta, Pathalia, Banagram, Kaundia, Tetuljhora and Amin Bazar. Dhaka-Aricha highway (N5) runs through the Amin Bazar, Tetuljhora, Savar Paurashava, Savar and Pathalia Unions (ADB, 2020). For this reason, these unions are more susceptible for spreading Covid-19 along the Dhaka-Aricha highway. Lots of infrastructures have been developed along this highway in these unions. Jahangirnagar University, National Memorial, Savar Cantonment and Savar dairy farm is most notable landmarks in Pathalia union at Savar. Military Dairy firm, Radio station and bank colony established along the Dhaka Aricha Highway in Savar Paurashava. Dhaka-Aricha road, which is one of the main highways that connects several divisions in Bangladesh, runs through the urban center of Savar Upazila and serves as the main artery of vehicular transport here.

Already COVID-19 spreads through the whole world. Bangladesh diagnosed about 3 lac 8 thousand 9 hundred twenty-five Covid-19 positive cases. In Savar Upazila, number of 1067 Covid-19 positive cases diagnosed (Huda, 2020). Thirty (30) positive patients died in Savar Upazila until today (08.07.20). Total sample collection in Savar Upazila health complex is 5783 and total discharge 1017 after cured.

Figure-02: Study Area (Savar Upazila)



Sources: Complied by Authors, 2020.

Table-02: At a glance of Savar Upazila

Description	Number
Total number of Population	1377940
Total Area	283 sq. km
Number of Union	12
Number of Sub-Center	03
Number of Community Clinic	37
Number of Medical College Hospital	03
Number of Sample Collection Booths	02
Number of RT-PCR Lab	03
Number of Nursing Institute	02
Number of Private Hospital	127
Number of Police Station	02
Number Land Office	03
Number University	07

Source: Upazila Health Complex, 2020

4. Result and Discussion

This research represents the Spatial distribution pattern and the age-sex structure of Covid-19 infected people. The age-sex structure is a graphical quantitative representation that exploits the Covid-19 affected people's age and sex of the study area. It's indicated the proportion of affected male and female in different age groups of Covid-19. The age-sex structure is a way to visualize two variables: age and sex. The diagram beginning from youngest at the bottom to oldest at the top (Sultana et. al, 2017; Haque, 2017). Generally, the age-sex structure also explicit the three age groups such as; Young age (0-14), Median age (15-64) and Old age (65+). The median age group is also known as the worker/active group of people who plays the vital role of the economy of places. Median age provides an important single indicator of the age distribution of a population. It provides the age 'midpoint' of a population; there are the same number of people who are older than the median age as there are younger than it. This age group of a population has important impacts for various aspects of society: economic growth rates, labor force participation, educational and healthcare services, housing markets amongst others. This structure visualizes of the Covid-19 affected population of study area. The width represents the size of the population of a given age; women on the right and men to the left.

According to Professor Dr Nazrul Islam (former vice-chancellor of Bangabandhu Sheikh Mujib Medical University and a virologist) "In Bangladesh, it is alarming that a child and young people also died here. But the scenario is different in other countries. This is because our health system is weak."

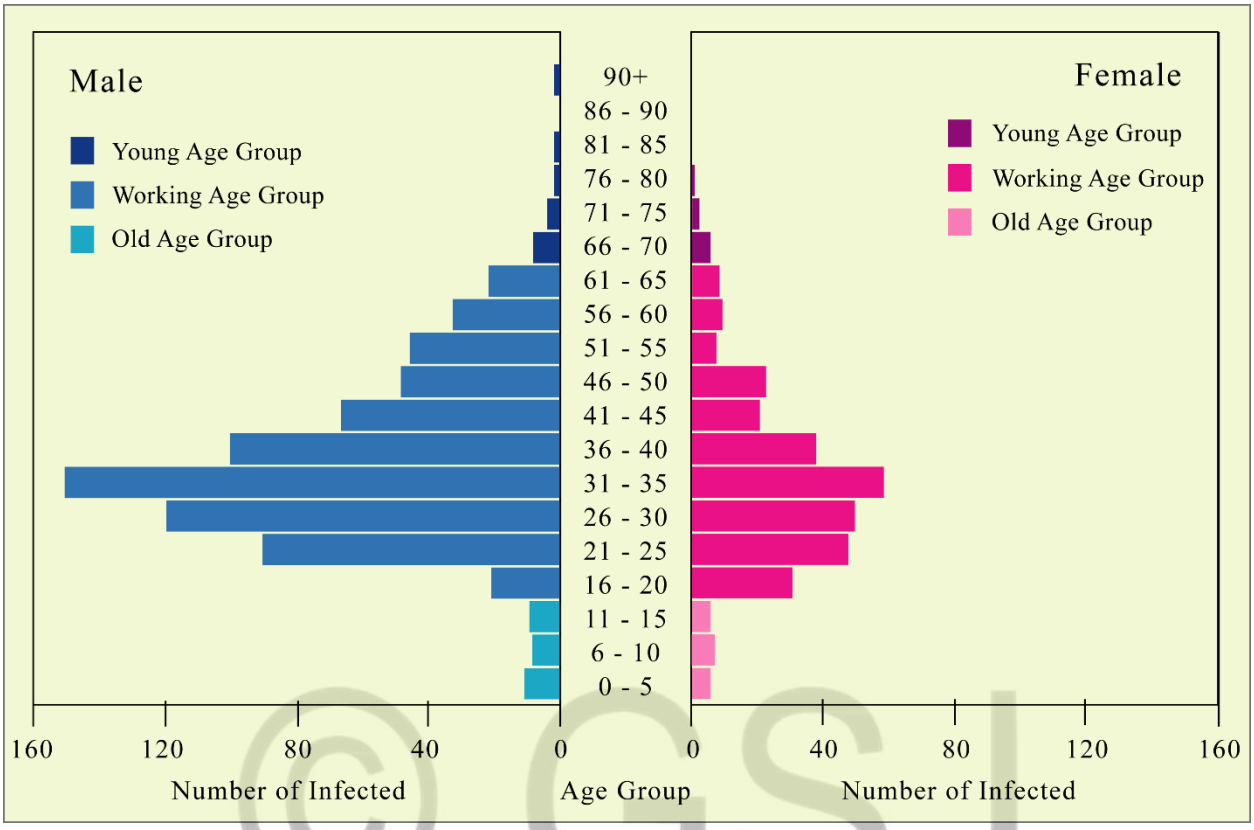
Young and working-age people have been infected most with the Covid-19 virus in Bangladesh. Data from the Institute of Epidemiology, Disease Control and Research showed that 62 percent (%) of the infected cases were aged between 21 and 50 years. An analysis of the coronavirus patients by age demonstrated that the highest proportion of the infected people are 23 percent (%) were between 31 and 40 years, followed by 20 percent (%) in the age bracket of 21–30 years and 19 per cent aged 41 to 50 years. The patients aged between 51 and 60 years constituted 15 percent (%) of the total infected people while the cases aged above 60 were 13 percent (%).

According to IEDCR's principal scientific officer ASM Alamgir, New Age that young and working-age people in Bangladesh were reluctant to follow the guideline on staying at home during the lockdown. 'It [the reluctance] could be a likely explanation for younger and working-age people in Bangladesh getting infected,' he said, adding that still the number of infected people in Bangladesh was low to draw a conclusion about the patterns among the infected people (Khan, 2007; WHO, 2020). 'Various countries have various situations and we are yet to know much about the new virus,' said Alamgir, who has expertise about influenza infection.

In Spain, people above 70 were the largest group to have been infected with the Covid-19, followed by 17 percent (%) in their 50s, 15 percent (%) in their 60s, 15 percent (%) in their 40s, 11 percent (%) in their 30s and 8 percent (%) in their 20s, according to a US CDC analysis (Rosenberg, 2019).

In Bangladesh, graph (Figure-03) shows the Corona virus affected peoples in different countries by different age group which appears differently (WHO, 2020). In this research shows the same feature. In Savar Upazila, working group is more affected from others group. Savar is an industrial region (garments) where most of peoples are worker and low-income group that's why this is hard to maintain Covid-19 rules. For complete their rudimentary needs, they are busy to try earn. According to professor Nazrul, "May be there immune system is weak. That's why, working age group peoples are more affected than other groups." In the graph (Figure-03), shows the affected Covid-19 by different age group of study area. The study also shows the male people are more affected but female is not less in consider to other areas because of female also worked in garments industry like male.

Figure-03: Age-sex structure of Covid-19 affected cases

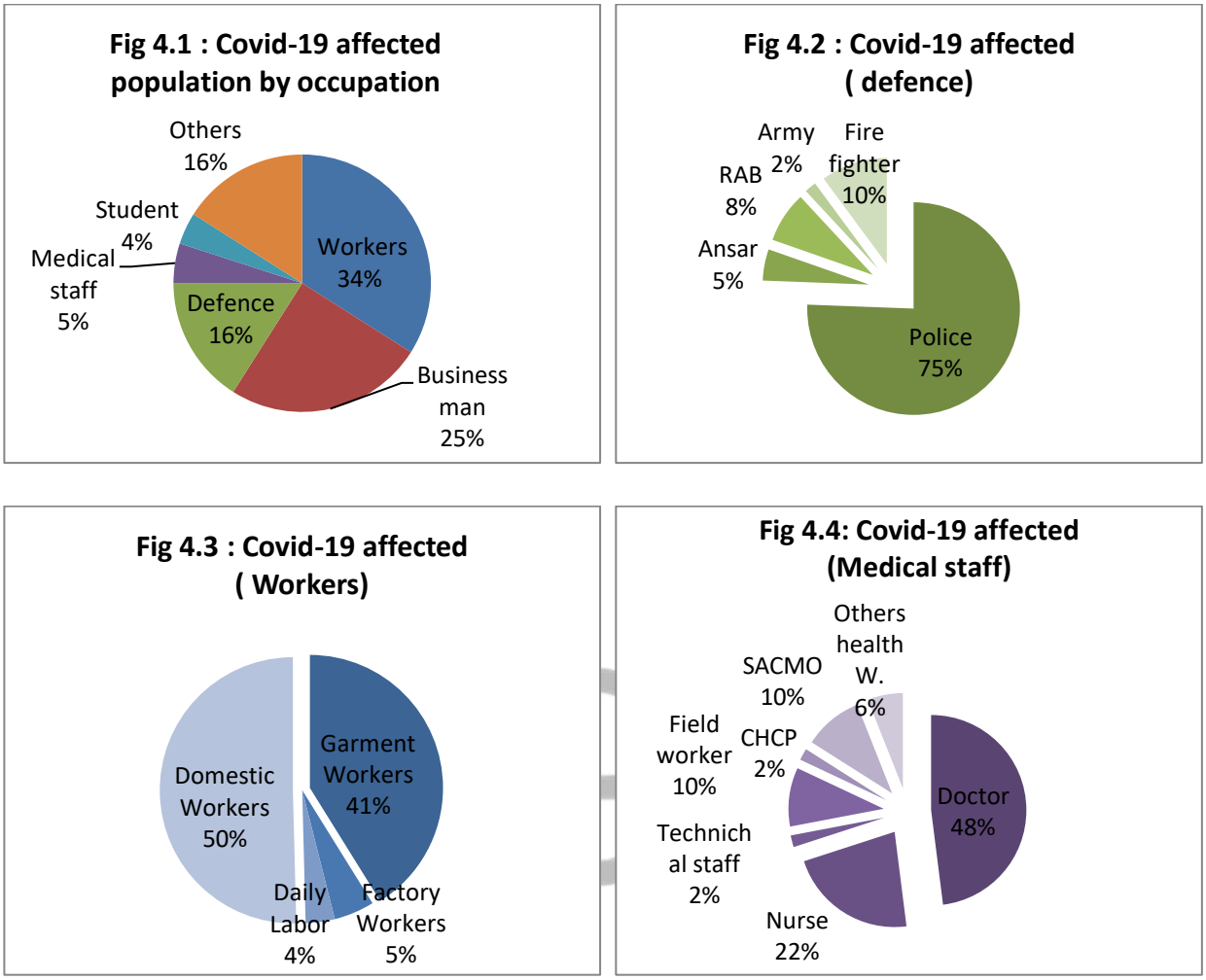


Sources: Complied by Authors, 2020.

5. Occupation Based Statistics

This research explored the Covid-19 affected cases by occupation. The study area is an industrial and fringe area of Dhaka city. So, workers most affected by Covid-19. Here, 34% of workers affected who are Garment workers, factory workers, domestic workers and daily labor; 50% of workers are domestic; 41% garment workers, factory workers; 5% and daily labor; 4%. Covid-19 cases of businessmen in this study in the second hierarchy which are 25% and 16% cases of Covid-19 are defense occupation people who are army, police, RAB and firefighter. Where 75% police, 10% firefighter, 8% RAB, 5% Anser and 2% Army. Medical staff who are known as front fighter of Covid-19, they are 5% affected in the study. Where doctors 48%, nurses 22%, field workers 10% and others 20%. In the research less Covid-19 cases infected are students, bankers, teachers etc. The Covid-19 cases of this study represents in figure-04.

Figure-04: Covid-19 cases by occupation in study area



Sources: Complied by Authors, 2020.

6. Infected and Death Statistics

In this research, Savar Upazila Covid-19 infected and death peoples are distributed on union wise. Here, Savar Paurashava more infected and more death rate than others union and Paurashava. The number of Infected and death of Savar Paurashava are 423 and 17. Savar Union is the next position to infected people are 216. Dhamsana, Ashulia and Tetuljhara Union are infected around 100 of total infected. Lowest infected in Bhakurta union. The highest number of deaths in Savar Pourshava. Savar Paurashava infected rate 40.33%; Savar Union infected rate 20.75%; Dhamsana Union infected rate 9.70%; Ashulia Union infected rate 9.41%; Shimulia Union infected rate 9.32% and the others union are less infected. Hight death rate 61% of 28 death in Savar Paurashava; Shimulia and dhamsana deart rete 11% and Kaundia

Union date rate 7%; other union wasn't any death history by Covid-19 depends on supplied data from Savar Upazila Health Complex. Here shown Infected and Death rate statistics (Table-03).

Table-03: Infected and Death of Covid-19 Savar Upazila (14 April-26 August, 2020)

Sl. no	Union	Number of Infected	Infected (%)	Number of Death	Death (%)
1	Aminbazar	5	0.48%	0	0%
2	Ashulia	98	9.41%	0	0%
3	Banagram	11	1.06%	0	0%
4	Bhakurta	1	0.10%	0	0%
5	Biralia	5	0.48%	0	0%
6	Dhamsana	101	9.70%	3	11%
7	Kaundia	2	0.19%	2	7%
8	Pathalia	53	5.09%	3	11%
9	Savar	216	20.75%	0	0%
10	Savar Paurashava	423	40.63%	17	61%
11	Shimulia	4	0.38%	0	0%
12	Tatuljhora	97	9.32%	3	11%
13	Yearpur	25	2.40%	0	0%
	Total	1041	100%	28	100%

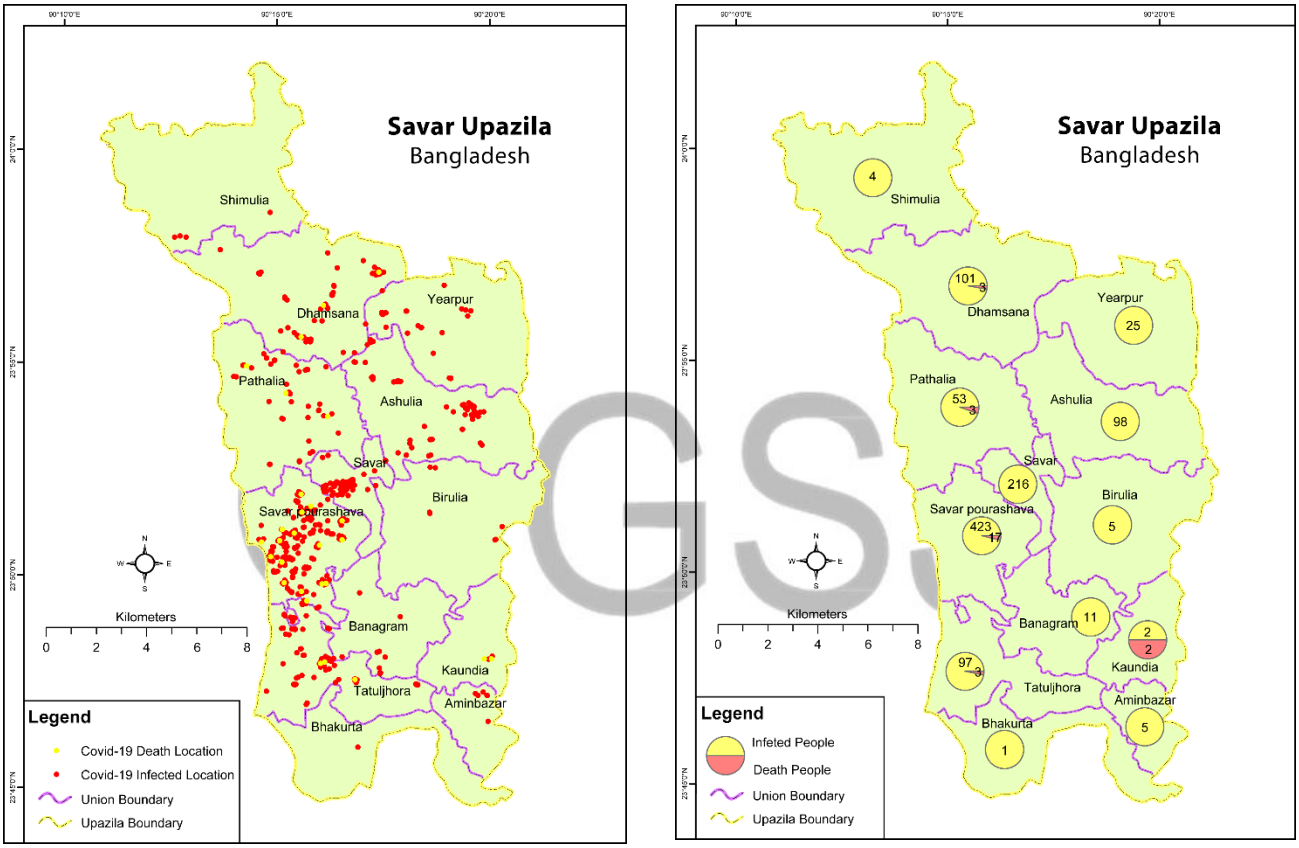
Sources: Savar Upazila Health Complex, 2020

7. Infected and Death Mapping

A thematic map focuses on a particular theme or special topics. Best example of early thematic mapping comes from London physician John Snow's early dot map. Though disease had been mapped thematically, Snow's cholera map in 1854 is the best-known example of using thematic maps for analysis (CDC, 2020). The study applies the thematic map for showing the affected people's absolute location which provide the clear picture of distribution of Covid-19 affected peoples of study area. A dot map uses dots to show the distribution of Covid-19 affected peoples and display a spatial pattern. A dot map is a popular way to use dots in creating a thematic map. Here one dot represents one affected case of Covid-19. The study uses the dot map which is a one-to-one map, each point is absolutely located in its spatial location on the map. However, the study area consists of one Paurashava and 12 other unions like Savar, Shimulia,

Dhamsona, Yearpur, Ashulia, Birulia, Bhakurta, Pathalia, Banagram, Kaundia, Tetuljhora and Amin Bazar. This map elucidates the most of the affected peoples in Savar Paurashava, then Savar union, next Tetuljhora and Dhamsona Union. Total 1067 cases of Covid-19 plotted in map where most of the cases in Savar Paurashava and Savar union, it also unearthed Covid-19 affected cases reduces with distance and more populated area more affected (according to gravity law) in study area (TBS, 2020).

Figure-05: Covid-19 Infected and Death cases in study



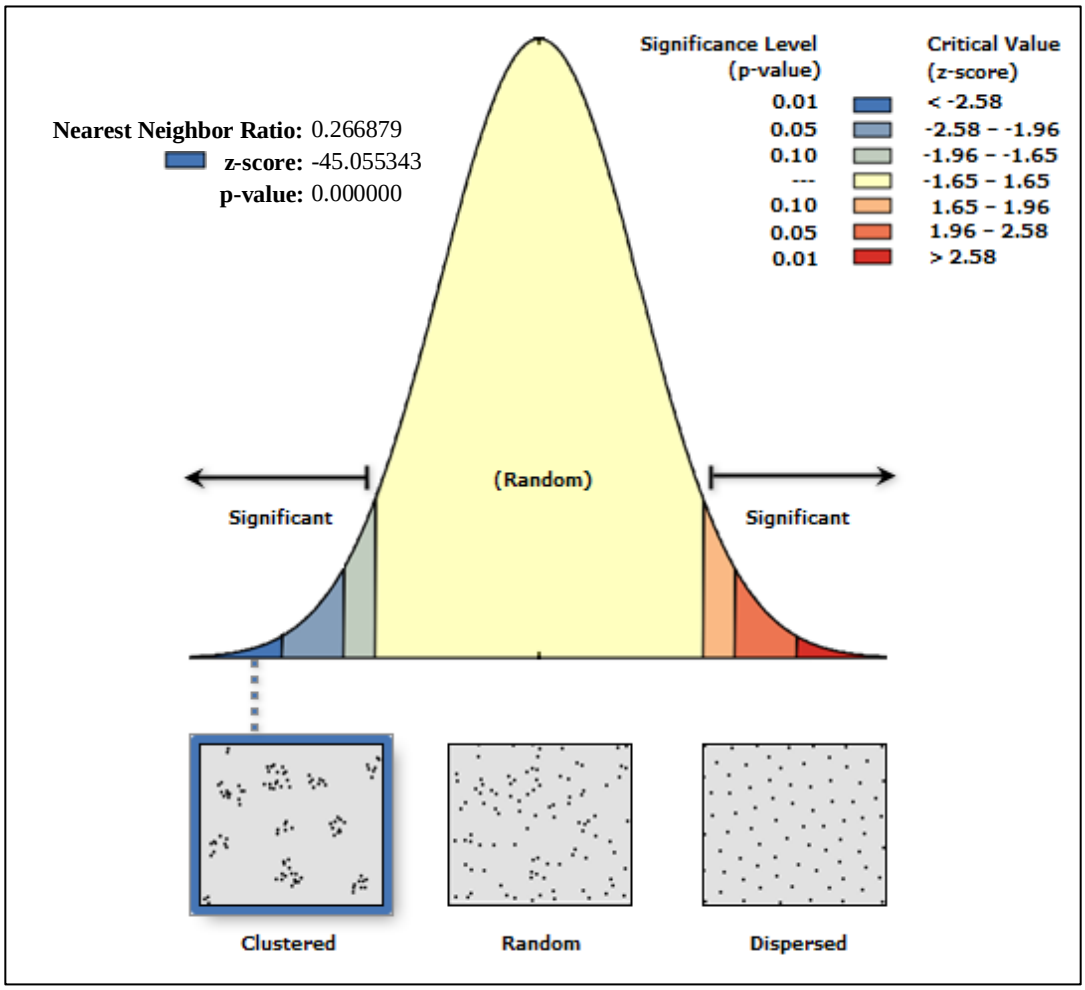
Sources: Complied by Authors, 2020.

8. Nearest Neighbor Index Analysis

The study uses the Nearest Neighbor Index for analysis the pattern of Covid-19. According to Royal Geographical Association, Nearest Neighbor Analysis measures the spread or distribution of something over a geographical space. It provides a numerical value that describes the extent to which a set of points are clustered or uniformly spaced (Maptrove, 2018). Nearest Neighbor Index value below 1 means cluster pattern, more than 1 means random and 2.15 value means regular pattern. This research displays the pattern of Covid-19 is clustered pattern and this Nearest Neighbor Index analysis value generated 0. 266879. This research null hypothesis was “the distributional pattern of the Covid-19 affected peoples of

Savar Upazila has no pattern and are the chance of random occurrences." In this research, the null hypothesis is rejected by the analysis and Alternative hypothesis is accepted here (figure-06).

Figure-06: Pattern analysis of Covid-19 affected cases in study area (NNI)



Sources: Complied by Authors, 2020.

9. Findings

- Covid-19 cases presents in dot map which shows the more affected area is Savar Paurashava.
- 70% infected and death cases of Covid-19 zones are Savar Paurashava and Savar union.
- Worker or the Active group of Peoples are more infected then others group.
- In working age group (31-35) age group more affected than others group.
- Doctor is more affected than other health staff.
- The study also unearthed the Pattern of Covid-19 in study area is Clustered Pattern.
- According to gravity law, Covid-19 affected cases reduces with distance in study.

- The research assist to Covid-19 management and planning for any region of Nation.

10. Conclusion

The present world is agitated to Covid-19 which already spread 214 countries, affected almost 36.9 million cases in the world. Bangladesh also affected country where total cases 374,592 (WHO, 08/10/20). The study contextualized the detailed geographical inquiry of Covid-19 cases in Savar Upazila of Dhaka city. The study explored numerous features such as; Covid-19 affected peoples pyramid, Covid-19 affected by occupation-wise data, created a dot map with affected peoples, and analyzed clustered pattern of Covid-19 in the study area. Working-age group (15-64) people most affected and males are more affected than females. The study area is an industrial region and situated fringe area of Dhaka city. Low-income people lived in this area who are not possible to follow all Covid-19 health rules. Some places of this area such as; Savar Paurashava, Savar union, Dhamsona union, Tetholjhora union overpopulated and those places are more affected than others. According to gravity law, distance and mass (population) are the exponent component. The result of this study more populated areas more affected than the less populated areas and affected by Covid-19 is related with distance. In this study, Savar Paurashava is a nodal area and affected people diminish with distance. Surrounding places of nodal place more affected than distant areas. The study is imperative to manage and planning for Covid-19. Now, it is indispensable to follow the WHO guidelines to mitigate Covid-19. Covid-19 is spreading and affected day by day.

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