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## THE SPATIAL STRUCTURE INFLUENCE ON THE RATE OF COVID-19 SPREAD IN MEDAN HELVETIA SUB-DISTRICT

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### ABSTRACT

This study is necessary to research the impact of spatial structure on Covid-19 based on a statement stating that population density and mobility affect the spread of the Covid-19 pandemic virus. Indeed, population density and mobility are essential indicators of spatial structure. This study aims to analyze the spatial structure of the Medan Helvetia Sub-District and examine the relationship between the influence of the spatial structure on the rate of Covid-19 virus spread in the Medan Helvetia Sub-District. The method used in this research is the qualitative method. The primary data sources are obtained through field observations and distributing questionnaires to respondents using the purposive sampling method. Meanwhile, the researcher obtained secondary data from literature related to the research object and The Medan City Regional Spatial Plan for 2010-2030. The result obtained is the discovery or absence of the spatial structure influence on the rate of Covid-19 virus spread in the Medan Helvetia Sub-District.

**KEYWORDS:** Covid-19, Density, Mobility, Pandemic, Spread, Spatial Structure.

### INTRODUCTION

The Covid-19 outbreak pandemic virus, or Corona, is an outbreak that occurs in various countries of the world. According to data from BBC Indonesia, as of October 2020, there were nearly 35 million confirmed cases with more than 1 million people passing away, occurring in 188 countries. The determination of the virus into the pandemic category by WHO is because the disease caused by the virus can be transmitted easily, from one person to another, and occurs at the same time in various countries of the world [1]. One of the efforts to stop the spread of this virus is to maintain a distance from other people, at least 1 meter, to avoid being exposed to droplets from people who are sneezing, coughing, or talking. It is recommended to avoid the crowding and jostling atmosphere. This prevention effort is known as physical distancing and social distancing [2].

The infectious disease caused by the Coronavirus has a direct relationship with urban development. Hang (2020) shows that the increasing density of cities has led to the rapid of the virus spread. By comparing the spreading of SARS-CoV in 2003 and SARS-CoV-2 in 2019/2020, it is evident that

population density influences the rapid spread. In the case of SARS-CoV in China, it infected more than 5000 people and killed more than 300 people over eight months. However, in the case of SARS-CoV-2, more than 4000 people were infected for seven weeks. It was related to the fact that cities in China have developed into dense and spacious urban areas, with higher population densities due to migration from rural to urban areas [3]. The population density and movement are closely related to the urban spatial structure. According to experts and environmentalists, it needs to be observed and reviewed. Moreover, there are many incidents, specifically in developing countries, these cities are developing without control. The increasing number of residents has resulted in increasingly dense and low-quality urban space, especially in dense settlements with a dense population.

As one of the developing countries exposed to the Covid-19 pandemic virus outbreak, Indonesia needs special attention. According to World meters, in December 2020, Indonesia was in the top five highest Covid-19 cases in Asia, with a total of 543,975 Covid-19 cases, 17,081 deaths, and 454,879 recoveries [4]. One of the provinces in Indonesia that ranks in the top 10 nationally related to the Covid-19 case is North Sumatra Province, which was in 9th national, as of October 29, 2020 [5]. Moreover, North Sumatra Province has also occupied the 6th national position and included in the top ten with the highest additions of cases in September and November 2020 [6]. From this high number, Medan City often contributes the highest from April 2020 until now.

Medan city is one of the three cities with the largest population in Indonesia, based on data from the Ministry of Home Affairs of the Republic of Indonesia 2017. It is the capital of North Sumatra Province which consists of 21 sub-districts. Of the total sub-districts, some of them have a history of high Covid-19 cases and a small number of them have low cases. One of the sub-districts that often occupies the highest rank is Medan Helvetia. On September 17, 2020, Medan Helvetia Sub-District was the highest, with 202 patients treated, 143 people recovering, and 13 deaths [7]. On October 16, 2020, the Medan Helvetia Sub-District was the highest, followed by the Medan Johor and Medan Timur Sub-Districts [8]. On November 6, 2020, Medan Helvetia Sub-District was one of the four sub-districts with the highest Covid-19 cases, along with three other sub-districts, namely Medan Sunggal, Medan Selayang, and Medan Johor [9]. On December 11, 2020, Medan Helvetia Sub-District occupied the second-highest position of positive Covid-19 cases, with 697 people, with the highest number of suspects, as many as 1063 people [10]. And on January 7, 2021, Medan Helvetia Sub-District also still occupies the second-highest position with 805 positive cases, and the highest number of suspects, 1248 people [11]. Therefore, it is necessary to study an assessment related to the spatial structure influence on the rate of the Covid-19 virus spread in this sub-district.

## **2. Object, Research Area, and Research Method**

### **2.1 Object and Research Area**

This research consists of two objects. Those are Medan Helvetia Sub-District and Covid-19.

### 2.1.1 Medan Helvetia Sub-District

Medan City is the capital city of North Sumatra Province. This city is the largest in the eastern region of Sumatra Island. Geographically, the area of Medan City is directly adjacent to Deli Serdang Regency in the West, East, and South and borders the Malacca Strait in the North. Astronomically, the location of Medan City is between 3°.27' - 3°.47' North Latitude and 98°.35' - 98°.44' East Longitude with an altitude of 2.5 - 37.5 meters above sea level. Most of the area of Medan City is lowland, with an altitude between 2.5-37.5 meters above sea level. Administratively, Medan City consists of 21 sub-districts, namely Medan Tuntungan, Medan Johor, Medan Amplas, Medan Denai, Medan Area, Medan Kota, Medan Maimun, Medan Polonia, Medan Baru, Medan Selayang, Medan Sunggal, Medan Helvetia, Medan Petisah, Medan Barat, Medan Timur, Medan Perjuangan, Medan Tembung, Medan Deli, Medan Labuhan, Medan Marelان, and Medan Belawan. Figure 1. shows the map of the Medan City area.

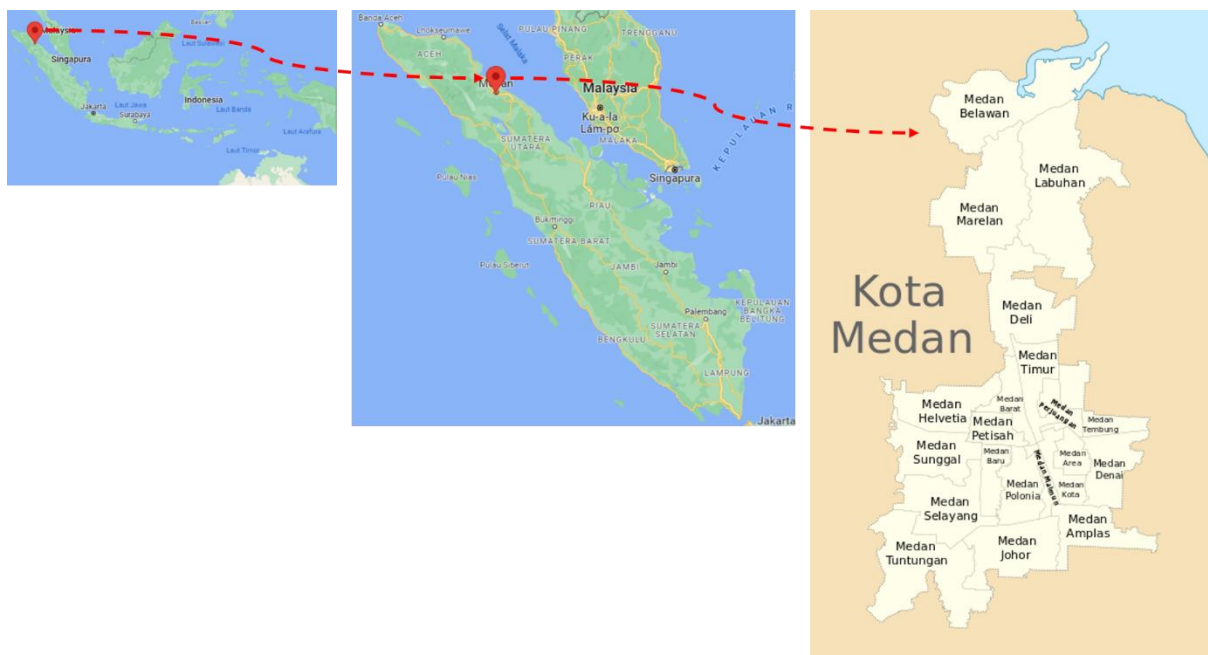
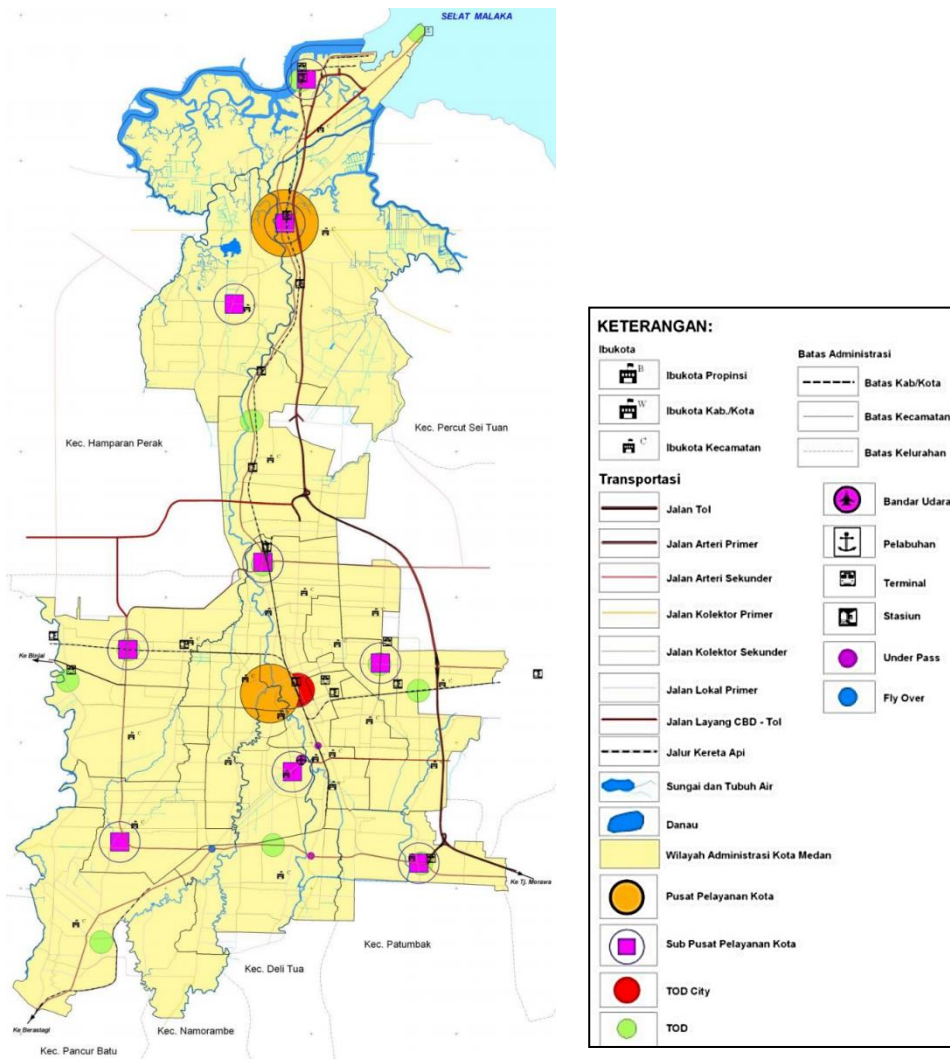


Figure 1. Map of Medan City

Medan City is the National Activity Center in the national urban system. The City of Medan includes in the Metropolitan Urban Area of Mebidangro. It directs as a global-scale National Activity Center, as a border crossing administration center that functions as a marketing outlet for the eastern part of North Sumatra while continuing to strengthen its functions. Linkages with international and regional growth centers. The city of Medan is also in the National Strategic Urban Area of Mebidangro. Therefore, in the context of the spatial structure plan of Medan City, it is necessary to have a system of service centers consisting of the City Service Center and the City Service Sub-center. The City Service Sub-center must integrate with the City Service Center. Based on the Medan City Regional

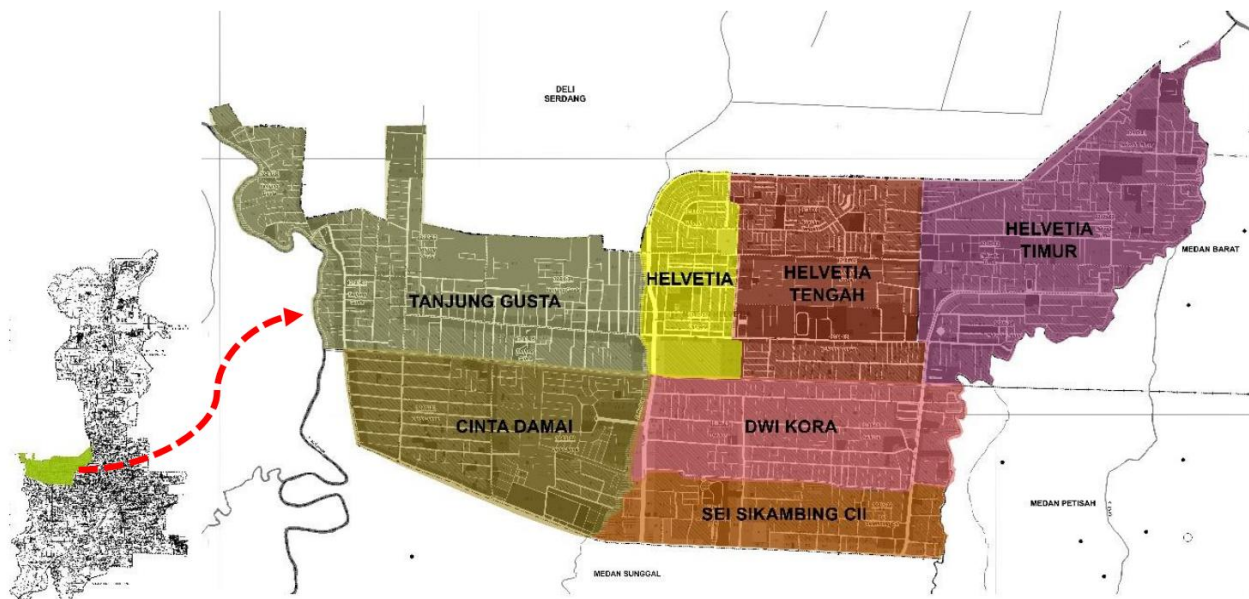
Spatial Plan for 2010-2030, Medan City has two city service centers, one city service center in the north and one city service center in the city center. Furthermore, there are eight services sub-center city to encourage the city's development towards the north so that the city's development between the south and north can distribute more evenly. It makes the Medan City becoming a Polycentric City. Figure 2. shows the points of the city service centers and the city service sub-centers [13].



**Figure 2. Plans for City Service Center Points and Medan City Service Sub-Centres based on the Medan City Regional Spatial Plan for 2010-2030**

One city service sub-center is the Medan Helvetia Sub-District, which functions as a center for economic, transportation, and socio-cultural activities and a service center for security defense. Geographically, this sub-district is directly adjacent to the Sub-District of Medan Sunggal in the south and west, the Deli Serdang Regency in the north, and the Sub-Districts of Medan Barat and Medan

Petisah in the east. Astronomically, the location of this sub-district is at  $03^{\circ}-2^{\circ}$  N,  $62^{\circ}-41^{\circ}$  South Latitude, and  $98^{\circ}-39^{\circ}$  East Longitude. Medan Helvetia Sub-District has an area of 11.55 km<sup>2</sup> and consists of seven villages, namely Cinta Damai, Sei Sikambang CII, Dwi Kora, and Helvetia Timur, Helvetia Tengah, Helvetia, and Tanjung Gusta. Figure 3. shows the map of the Medan Helvetia Sub-District.



**Figure 3. Map of Medan Helvetia Sub-District**

According to the Detailed Spatial Plan for the Medan City Region, Sub-Activity of the Detailed Spatial Plan for the Medan Helvetia Sub-District, land use in the Medan Helvetia Sub-District has two parts, namely the use of built and undeveloped land. Built-up land use is where there are physical buildings such as settlements, facilities and infrastructure, settlements, and shops. In comparison, the use of undeveloped land is land use where there is no physical building but for agriculture, plantations, irrigation, ponds, and forests.

Land use data in Medan Helvetia Sub-District indicates that the area of Medan Helvetia Sub-District is mainly settlements covering an area of 573.52 hectares (49.60 %) and others covering an area of 334.90 hectares. (28.97%). Although Medan Helvetia Sub-District is an urban area, agricultural activities still occupy an area of 42.75 ha (3.70%), and industrial activities occupy an area of 20.90 ha (1.81%). Medan Helvetia Sub-District, seen from its position and role in Medan City, is a secondary service sub-center. This sub-district is the 'gateway' of Medan City from the direction of Binjai City and Nanggroe Aceh Darussalam Province. With its position as the gateway, either directly or indirectly, the 'face' of Medan City will be judged by the existence of the Medan Helvetia Sub-District.

### 2.1.2 Covid-19

The Covid-19 virus pandemic is not only related to medical science. But more than that, this pandemic has close links with various other fields of science, one of which is the science of spatial structure. The indicators of the Covid-19 pandemic that are related to the spatial structure are as follows:

#### a) Physical Distancing (Restriction of Physical Contact)

Physical Distancing or physical contact restrictions play an important role in slowing the transmission of the Coronavirus and the disease it causes, COVID-19. The overcrowding of cities, historically regarded as their most significant asset economically, socially, and environmentally, is now at odds with the reality of the pandemic and has become a crippling vulnerability. The Centers for Disease Control (CDC) recommends maintaining a physical distance of 6 feet (1.8 meters), as shown in Figure 4., based on the assumption that COVID-19 spreads from infected people when they cough, sneeze or talk [16].

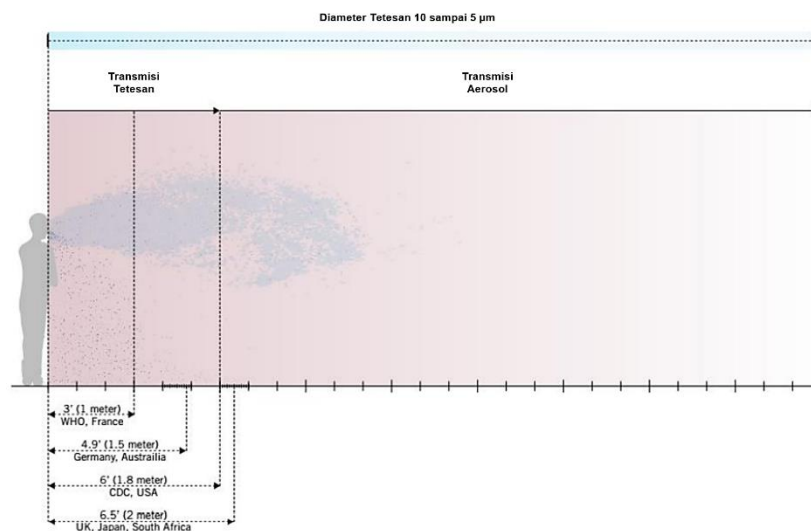


Figure 4. Standardization of Physical Distancing according to CDC and WHO

#### b) Social Distancing

According to the Public Health Department article, social Distancing is an effort to prevent the transmission of certain diseases by creating distance between oneself and others. In Indonesia, Law Number 6 of 2018 concerning Health Quarantine articles 59 and 60 states that social Distancing is the restriction of certain activities of residents in an area suspected of being infected with a disease and contaminated in such a way as to prevent the possible spread of disease or contamination [17].

#### c) Contribution of the Closed Environment to the Spread of Covid-19

A study in Japan used contact tracing to identify that a closed environment was 18.7 times more likely to be a site of transmission of Covid-19 than an open-air environment. This study used contract tracing to examine 110 cases, of which 27 were primary in Japan. The report concludes that it is logical that a

closed environment contributes significantly to the spread and secondary transmission of Covid-19 [16].

## 2.2 Research Method

Researchers used a qualitative approach to identify spatial structure's influence on the spread of the Covid-19 virus in the Medan Helvetia Sub-District. It is because the method is a research approach carried out by describing a phenomenon experienced, namely the Covid-19 virus outbreak, by the research subject, namely the spatial structure in Medan Helvetia Sub-District, so that researcher obtains knowledge of the cause and effect of the phenomenon. The data from the qualitative method approach is then linked to a literature review related to the spatial structure and indicators of the spatial arrangement and relates it to the current condition of the spatial system in the Medan Helvetia Sub-District. In collecting data related to Covid-19 cases, researchers used secondary and primary data. Secondary data was obtained from the Medan City Health Office, containing data on Covid-19 cases in Medan Helvetia Sub-District from April - to December 2020. At that time, Covid-19 cases in Medan City were increasing, and there had no been the Covid-19 vaccine. So that all community activities are at home (work from home). Meanwhile, the researcher obtained primary data through questionnaires carried out within a week, from February 25 to March 4, 2022. At that time, Medan City had level 3 status regarding Covid-19 cases, and the public had received the first and second vaccines. So that community activities can be carried out outside the home, but by continuing to apply social distancing and physical distancing, as well as time restrictions outside the home.

In determining the research location, the researcher uses a purposive method, which is a method of determining the research location intentionally based on specific considerations. The criteria for considering the determination of the research location made by the researchers include:

- a) The District in Medan City is often in the highest position regarding cases of the Covid-19 disease outbreak and has the highest number of points (Table 1).
- b) The researcher analyzes the highest village population density in the sub-district (Table 2).
- c) Villages in the sub-district dominate the highest increase in Covid-19 cases (Table 2).

**Table 1. Site Selection Criteria for Criteria (1)**

Sub-Districts in Medan City	Criteria (1)	
	Occupies the Highest Cases per Month	Number of Covid-19 cases
Medan Area	April (once)	357
Medan Amplas	June (once)	470
Medan Barat	-	269
Medan Baru	-	402
Medan Belawan	-	109
Medan Deli	-	225
Medan Denai	-	566
Medan Helvetia	August, September, November, December (4 times)	799
Medan Johor	July, October (twice)	723
Medan Kota	-	434
Medan Labuhan	-	137
Medan Maimun	-	235
Medan Marelan	-	229
Medan Perjuangan	-	355
Medan Petisah	-	321
Medan Polonia	-	138
Medan Selayang	May (once)	764
Medan Sunggal	-	603
Medan Tembung	-	357



Sub-Districts in Medan City	Criteria (1)	
	Occupies the Highest Cases per Month	Number of Covid-19 cases
Medan Timur	-	513
Medan Tuntungan	-	597

**Table 2. Site Selection Criteria for Criteria (2) and Criteria (3)**

Villages in Medan Helvetia Sub-District	Criteria (2) Population Density (people/km <sup>2</sup> )	Criteria (3) Increase in the number of Covid-19 cases
Cinta Damai	10,116	12
Sei Sikambing C II	13,380	5
Dwi Kora	12,979	17
Helvetia Timur	14,125	17
Helvetia Tengah	18,838	40
Helvetia	9,675	10
Tanjung Gusta	14,589	26

Based on the three tables above, it is found that the Medan Helvetia sub-district is the sub-district that best meets criteria 1 in determining the research location. The sub-districts that best met criteria 2 and 3 were Central Helvetia Village, Tanjung Gusta Village, and East Helvetia Village. From the three selected villages, the researchers then determined the areas included in the city service sub-center zone and open spaces in each town chosen, as shown in Table 3.

**Table 3. List of City Service Sub-Center Zone Locations and Open Spaces in Selected Villages**

Villages	City Service Sub-Center Zone				Open Space
	Economic	Transportation	Socio-Cultural	Defense and Security	
Helvetia Tengah	Pujasera Simpang 7 Gaperta	-	Puskopad Building	-	Jasdam Square
	Helvetia Market	-	-	-	-
Tanjung Gusta	Kelambir Lima Market	-	-	Penitentiary Class 1 Tanjung Gusta	-
Helvetia Timur	Mandiri Express Supermarket	-	Suganda Yon Zipur Hall Building	-	Jipur Square

In determining the total population, the researchers identified statistical data on Covid-19 cases in the sub-district, which were sourced from the Medan City Government, specifically for sub-districts with the highest increase in Covid-19 instances and with the highest density distribution. This method is called the purposive method because researchers make considerations regarding the category of Covid-19 case data and the density level of each of these villages. The population in this study are people who have visited the city service sub-center zone and selected open spaces from the three urban villages, both those who live in the related village and those from outside the connected town. This population is included in the type of infinite population, and the unit of analysis is individuals with an age limit of 12 years and over and knowing the Covid-19 virus pandemic.

Based on consideration of the population and time constraints, sampling was carried out using the Non-Probability Sample (Selected Sample) method using the Convenience Sampling technique, and the sample was selected with convenience. The procedure takes a person as a sample because that person is at the research location or the researcher knows the person. Therefore, another term for this technique is accidental sampling. This study will take a sample of 122 within one week with one data collection period (One-Shot or Cross Section Studies). The percentage of each research location is 15% for each site that has the potential to be busy every day, namely markets, supermarkets, and food courts. Meanwhile, areas that are only potentially crowded at certain times have a percentage of 8% of the total sample. The rate of representatives from each location is shown in Table 4. below.

**Table 4. Percentage of Samples from Each Selected Location**

Selected Villages	Selected Locations	Percentage of Samples	Number of Samples
Helvetia Tengah	Pujasera Simpang 7 Gaperta	15%	18
	Helvetia Market	15%	18
	Puskopad Building	8%	10
	Jasdam Square	8%	10
Tanjung Gusta	Kelambir Lima Market	15%	18
	Penitentiary Class 1 Tanjung Gusta	8%	10
Helvetia Timur	Mandiri Express Supermarket	15%	18
	Suganda Yon Zipur Hall Building	8%	10
	Jipur Square	8%	10
<b>Total</b>		<b>100%</b>	<b>122</b>

The analysis was carried out with a qualitative approach to the data obtained, grouped, and categorized to be then made and presented in the form of descriptions, tables, pictures, and maps. The data group is then analyzed and interpreted to get answers to the formulation of the problem in this study. In analyzing the effect of population density on Covid-19 spread, the researcher ranked the level of density distribution in each selected village, starting from the highest to the lowest density level, presented in the form of a density distribution hierarchical map. Then the density distribution hierarchy obtained is linked or compared with the Covid-19 cases in each of the selected villages.

In analyzing the effect of the density profile on the rate of spread of Covid-19, the researchers calculated the percentage of service center sub-zones in selected sub-districts in Medan Helvetia District, then compared it with the level of Covid-19 cases in each of the chosen sub-districts.

In analyzing the effect of movement patterns on the rate of spread of Covid-19, the researchers processed the questionnaire results by conducting validity and reliability tests and conducting a descriptive analysis.

a) Validity Test

The primary testing is:

- $r - \text{count} > r - \text{table} = \text{valid table data or indicators (can be used)}$ .
- $r - \text{count} < r - \text{table} = \text{invalid table data or indicator (cannot be used)}$ .

b) Conducting reliability tests.

The references in the reliability test are:

- If the alpha value  $< 0.60$ , then the level of reliability is not good.
- If the alpha value is between  $0.60 - 0.70$ , then the level of reliability is quite good.
- If the alpha value  $> 0.70$ , then the level of reliability is good.
- If the alpha value  $> 0.80$ , then the level of reliability is excellent.

c) Descriptive analysis, namely by presenting statistical data from questionnaires that have been processed using the Crosstabulation technique. The results of the questionnaire are presented in the form of a description.

### 3. DISCUSSION

#### 3.1 Medan Helvetia Sub-District Spatial Structure

To examine the spatial structure in Medan Helvetia Sub-District, the researcher refers to three indicators of urban spatial structure: population density distribution, density profile, and movement patterns.

##### 3.1.1 Medan Helvetia Sub-District Density Distribution

Based on data from the Central Statistics Agency of Medan City, the population density in Medan Helvetia District per km<sup>2</sup> by villages in 2019 is shown in Table 5.

**Table 5. Total Population, Village Area, Population Density per km<sup>2</sup> by Urban Village in 2019**

	<b>Villages</b>	<b>Number of Population (people)</b>	<b>Villages Area (km<sup>2</sup>)</b>	<b>Population Density (people/km<sup>2</sup>)</b>
<b>Medan Helvetia Sub-District</b>	Cinta Damai	18,209	1.80	10,116
	Sei Sikambang CII	13,113	0.98	13,380
	Dwi Kora	25,959	2.00	12,979
	Helvetia Timur	25,708	1.82	14,125
	Helvetia Tengah	28,258	1.50	18,838
	Helvetia	12,094	1.25	9,675
	Tanjung Gusta	32,096	2.20	14,589

	<b>Jumlah</b>	<b>155,437</b>	<b>11.55</b>	<b>13.457</b>
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Table 6. shows that the density distribution in Medan Helvetia Sub-District is less evenly distributed. In contrast, the most extensive density distribution is in the Helvetia Tengah, with a density level of 18,838 people/km<sup>2</sup>. The lowest density distribution is in Helvetia, with a density level of 9,675 people/km<sup>2</sup>.

### 3.1.2 Density Profile of Medan Helvetia Sub-District

To see the density profile of the Medan Helvetia Sub-District, it is necessary to first look at the service sub-center points of the Medan City located in this sub-district. According to the Medan City Regional Regulation Number 13 of 2011 concerning the Medan City Regional Spatial Plan for 2010-2030, in Part Two concerning the City Service Center System Plan, article 14 paragraph (6) letter f states that the Medan Helvetia city service sub-center functions as an economical service center, transportation service center, and center for socio-cultural activities, as well as defense and security service center. The zones included in the financial service center have service and trade activities [13]. Helvetia District's financial service center zones are trade, commercial services, offices, industry, and warehousing zones (Map of Spatial Patterns and Zoning Plans for Medan Helvetia Sub-District). Included in the transportation service center according to the starting and ending points of movement are road terminals (bus stations, bus stops, and others). Areas included in the center of socio-cultural activities are areas related to community activities, worship, and cultural activities (culture). In addition, what includes in the defense and security service center in the Medan Helvetia Sub-District is an area in the defense and security zone.

### 3.1.3 Movement Pattern for Medan Helvetia Sub-District

Observing the movement patterns in the Medan Helvetia Sub-District can be done by analyzing the road hierarchy in the sub-district. According to Government Regulation of the Republic of Indonesia Number 34 of 2006 concerning Roads, primary arterial roads are roads that efficiently connect national activity centers or between national and regional activity centers. In comparison, secondary arterial roads connect the immediate area with the first secondary area, the first secondary area with the first secondary area, or the second secondary area with the second secondary area. In addition, the secondary collector road is a road that connects the second secondary area or between the second secondary area and the third secondary area. In addition, primary local roads are roads that efficiently connect national activity centers with environmental activity centers, regional activity centers with environmental activity centers, local activity centers, regional activity centers, and environmental activity centers, and between ecological activity centers. This hierarchy integrates the characteristics of each sub-district component into a large structure. The relationship of each path can be seen in Figure 5.



**Figure 5. Hierarchy of Road Types in Medan Helvetia Sub-District**

The existing condition of Medan Helvetia Sub-District shows that trade and commercial services connect primary arterial roads, secondary arteries, secondary collectors, and primary locales. Both of these functions have the potential to create crowds and crowds, which are closely related to the spread of the Covid-19 virus.

### **3.2 The Influence of Spatial Structure on the Spread of the Covid-19 Virus in Medan Helvetia Sub-District**

To examine the influence of spatial structure on the spread of the Covid-19 virus in the Medan Helvetia Sub-District, the researchers referred to the three indicators of the spatial structure associated with Covid-19 case data.

#### **3.2.1 Effect of Population Density on the Covid-19 Pandemic in Medan Helvetia Sub-District**

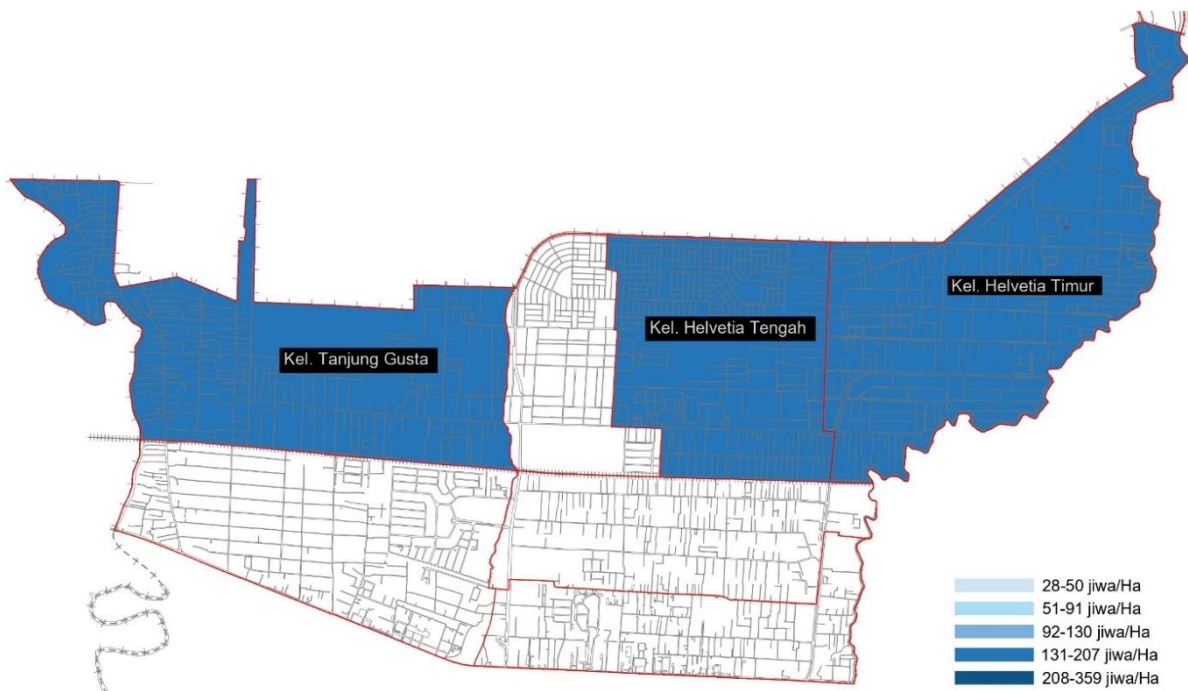
Based on the population density map from the Medan City Regional Spatial Plan (RTRW) 2010-2030, there are five classifications, which, if categorized, can be grouped into scarce, rare, medium, dense, and very dense categories, as follows.

- 1) 28 – 50 people/ha (very rare)
- 2) 51 – 91 people/ha (rare)
- 3) 92 – 130 people/Ha (medium)
- 4) 131 – 207 people/ha (dense)
- 5) 208 – 359 people/Ha (very dense)

Therefore, based on population density data from the Central Bureau of Statistics of Medan City 2020, Meda Helvetia Sub-District, which has a population density of 134.6 people/ha, belongs to the 4th classification class (131 – 207 people/ha), which is included in the solid category. Likewise, when viewed from the population density per village, the three selected villages, namely Helvetia Tengah, Tanjung Gusta, and Helvetia Timur are also classified as dense, as shown in Table 6. and Figure 6. below.

**Table 6. Population Density in 3 Selected Villages in Medan Helvetia Sub-District**

Medan Helvetia Sub-District	Villages	Population Density (people/Ha)	Population Density Group	Order of Population Density
	Helvetia Timur	141.3	Dense	3
	Helvetia Tengah	188.4	Dense	1
	Tanjung Gusta	145.9	Dense	2



**Figure 6. Population Density Map in 3 Selected Villages in Medan Helvetia Sub-District**

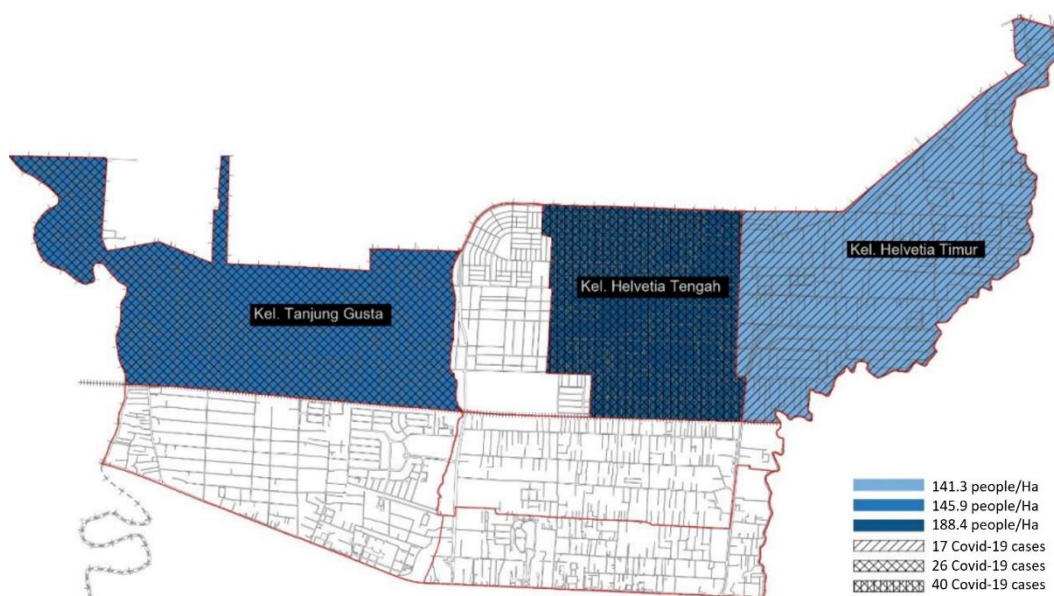
Based on Table 6. it can be seen that Helvetia Tengah is the most populous village and Helvetia Timur is the sparse village. Furthermore, to review the effect of population density on the spread of the Covid-

19 virus, researcher also examined the level of reach of the Covid-19 virus in the three urban villages, as shown in Table 7.

**Table 7. Order of 3 Selected Villages in Medan Helvetia Sub-District Based on Population Density Level and Spread of Covid-19 Virus**

Medan Helvetia Sub-District	Villages	Population Density (people/Ha)	Order of Population Density	Increase in the number of Covid-19 cases	Order of increasing number of Covid-19 cases
	Helvetia Tengah	188.4	1	40	1
	Tanjung Gusta	145.9	2	26	2
	Helvetia Timur	141.3	3	17	3

The population density map and the rate of spread of the Covid-19 virus can be seen in the image below.



**Figure 7. Map of Population Density and Spread of Covid-19 Virus in 3 Selected Villages in Medan Helvetia Sub-District**



Based on tables and maps of population density and the rate of spread of the Covid-19 virus in 3 selected urban villages in Medan Helvetia Sub-District, the order of population density levels and the order of increase in the number of Covid-19 cases is directly proportional. Helvetia Tengah, the village with the highest population density, has the highest rate of spread of the Covid-19 virus. It is followed by Tanjung Gusta, whose population density is in the second position and has the second rank of spreading the Covid-19 virus. And the Helvetia Timur Village, which has the lowest population density, also has the lowest rate of spread of the Covid-19 virus. It shows an influence between the level of population density and the Covid-19 virus spread in the Medan Helvetia Sub-District. In addition, the results of this analysis also confirm the Hang theory (2020), which states that increasing city density has caused the rapid spread of the virus, as well as Hardianto's theory (2020) which states that population density has a role in the Covid-19 virus spread in Indonesia.

### 3.2.2. The Influence of Density Profiles on the Covid-19 Pandemic in Medan Helvetia District

To obtain an overview of the density profile in the Medan Helvetia Sub-District, it is necessary first to understand the sub-zones of the city service center in this sub-district. Based on the Medan City Regional Spatial Plan for 2011-2031, the zones included in the city service sub-centers in 3 selected urban villages in Medan Helvetia Sub-District are shown in Figure 8.



**Figure 8. City Service Center Sub-Zone Map in 3 Selected Villages in Medan Helvetia Sub-District**

Figure 8. shows that Helvetia Timur has the most complex sub-zone of service centers. The colors of the sub-service center zones in this sub-district are the most complete compared to the other two sub-

districts. In Helvetia Timur Village, there are all colors of service sub-centers, namely red (trade), pink (commercial services), purple (offices), blue (public service facilities), and brown (defense and security). Meanwhile, in Helvetia Tengah Village, even though it has a complete service center sub-zone, the office zone (purple) area is minimal, i.e., 0.07% of the total area of the village. In addition, Tanjung Gusta Village does not have an office zone (purple) and only has a commercial service zone (pink) with a small percentage of area, which is 0.8% of the village's total area. The rate of service center sub-zones in the three selected villages is as follows.

**Table 8. Percentage of Service Center Sub Zones in 3 Selected Villages in Medan Helvetia Sub-District**

<b>Medan Helvetia Sub-District</b>	<b>Villages</b>	<b>Area of Sub Service Center Zone (km<sup>2</sup>)</b>	<b>Village Area (km<sup>2</sup>)</b>	<b>Percentage of Service Center Sub Zone (%)</b>
	Helvetia Timur	0.56	1.82	30.84
	Helvetia Tengah	0.46	1.50	30.40
	Tanjung Gusta	0.48	2.20	22.01

Suppose the percentage of this service center sub-zone is compared with the increase in Covid-19 cases in the three villages. The result is that the area of the sub-service center zone does not affect the spread of the Covid-19 virus because the Helvetia Timur Village, which is a village with a percentage of the largest sub-center of service, became the sub-district with the lowest rate of spread of the Covid-19 virus. In addition, Helvetia Tengah Village, the village with the highest rate of the Covid-19 virus spread, has the second percentage of service center sub-zones, as shown in Table 9 below.

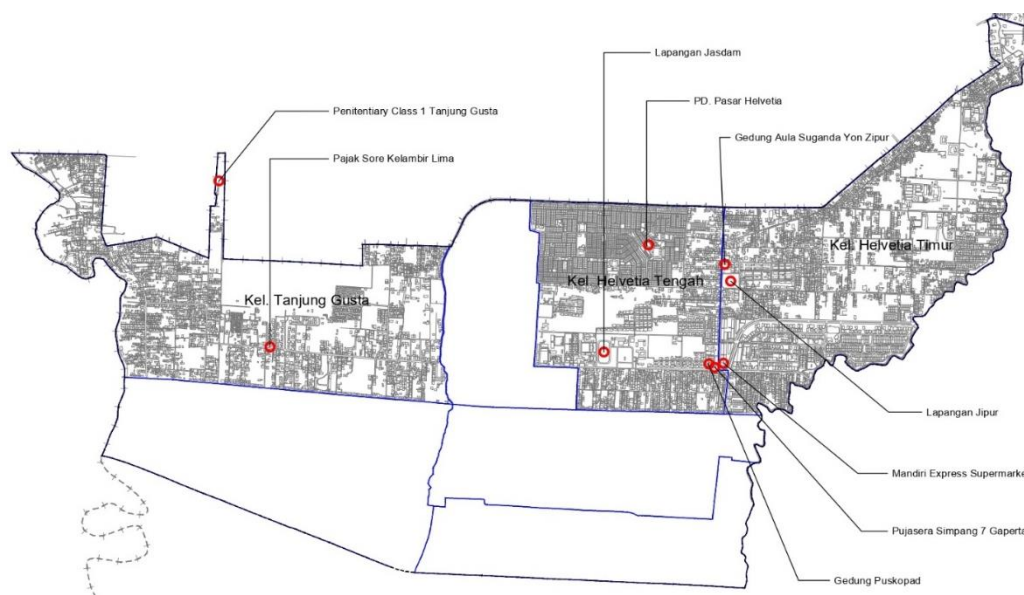
**Table 9. Order of Villages in Medan Helvetia Sub-District Based on Percentage of Sub Service Center Zones and Level of Spread of the Covid-19 Virus**

<b>Medan Helvetia Sub-District</b>	<b>Villages</b>	<b>Percentage of Sub Service Center Zones (%)</b>	<b>Order of Service Center Sub Zones Percentage (%)</b>	<b>Increase in the number of Covid-19 cases</b>	<b>Order of increase in the number of Covid-19 cases</b>
	Helvetia Timur	30.84	1	17	3
	Helvetia Tengah	30.40	2	40	1
	Tanjung Gusta	22.01	3	26	2

Table 9. indicates that the area of the service center sub-zone does not affect the spread of the Covid-19 virus. Therefore, another factor is the place of residence of the people who visit the sub-zones of the service center. It is essential to analyze because the address of the patient's home is recorded in the system, not the location when the patient was infected with this virus. The currently available system cannot analyze or predict the site when someone is infected with the Covid-19 virus.

### 3.2.3. The Effect of Movement Patterns on the Covid-19 Pandemic in Medan Helvetia District

In reviewing the influence of movement patterns on the Covid-19 pandemic in Medan Helvetia Sub-District, researchers distributed questionnaires to nine selected locations spread over three villages with the highest rate of spread of the Covid-19 virus. The nine locations are Pujasera Simpang 7 Gaperta, PD. Helvetia Market, Kelambir Lima Market, Mandiri Express Supermarket, Puskopad Building, Suganda Yon Zipur Hall Building, Penitentiary Class 1 Tanjung Gusta, Jasdram Square, and Jipur Square, as shown in the image below.



**Figure 9. Selected Locations for Questionnaire Distribution in Medan Helvetia Sub-District**

Of the 122 respondents, 60% were male and 40% female (Figure 10), with the majority being over 45 years old (Figure 11) and residing in Helvetia Tengah Village (Figure 12). Most of the respondents work as private employees, which is 34% of the total respondents, and self-employed, which is as much as 30% of the total respondents (Figure 13). More than half of the respondents have a history of Senior High School education, which is 51% of the total respondents (Figure 14).

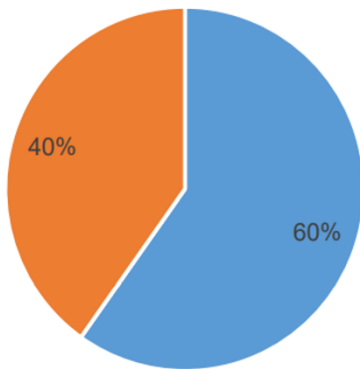


Figure 10. Gender of Respondents

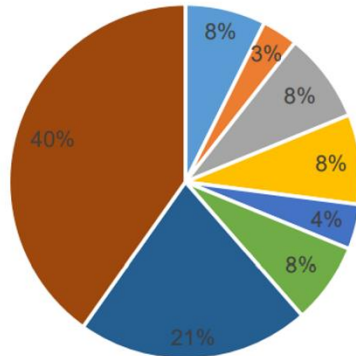


Figure 11. Respondent's Age

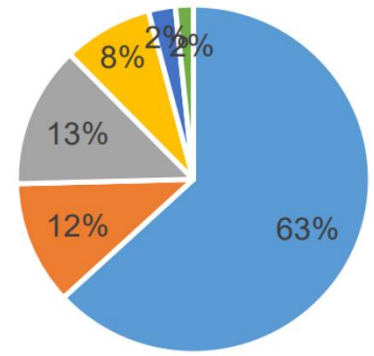


Figure 12. The Village where Respondents Live

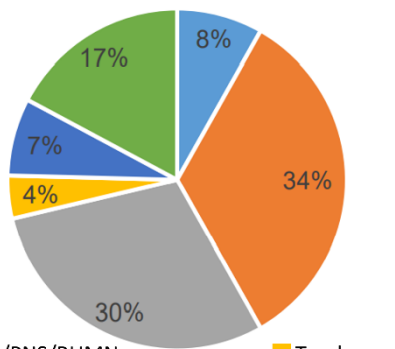


Figure 13. Respondent's Occupation

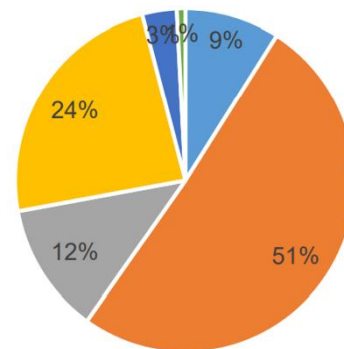
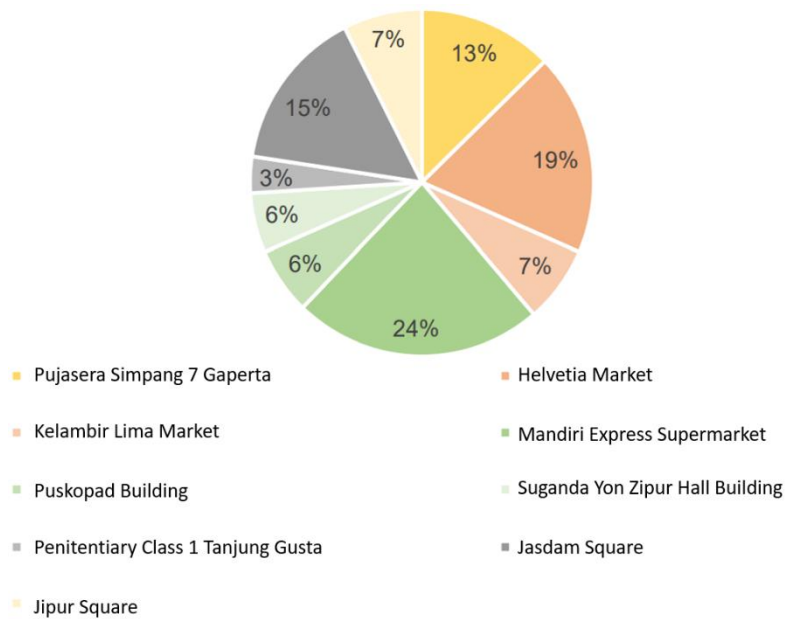


Figure 14. Education of Respondents

The questionnaire results show that of the nine selected locations, Mandiri Express Supermarket, located in Helvetia Timur Village, is the location most visited by respondents, as many as 24%. It is followed by Helvetia Market, situated in Helvetia Tengah Village, has as many as 19% of respondents, and Pujasera Simpang 7 Gaperta in Helvetia Tengah Village, as many as 13% of respondents, as shown in Figure 15.



**Figure 15. Frequently Visited Places by Respondents in Selected Locations in Medan Helvetia Sub-District**

Next, the researcher made a line map of the respondent's daily movements. Based on the map, most of the respondents live in the Helvetia Tengah Village. So, even though the Mandiri Express Supermarket, the location most visited by respondents, is located in the Helvetia Timur Village, the people who frequently visit it are those who live in Helvetia Tengah, as shown in Figure 16 below.



**Figure 16. Line Map of Respondents' Movement in Medan Helvetia Sub-District**

In addition, researchers also analyzed data using the Crosstabulation technique in reviewing the influence of movement patterns on Covid-19. Before the data was processed, validity and reliability tests were conducted on the questionnaire. The results of the validity test indicate that the questionnaire is valid. In addition, the results of the reliability test on the movement pattern indicator showed an alpha value of  $0.6 < x < 0.7$ , so it is included in the reasonably good category, and the Covid-19 hand showed an alpha value of  $0.7 < x < 0.8$  so it is included in the excellent category. The results of data processing with the Crosstabulation technique are as follows.

a) In a day I spend time outdoors during \*Covid-19 Crosstabulation

**Table 10. In a day I spend time outside the house for \* I believe in the Covid-19 virus Crosstabulation**

		I believe in the Covid-19 virus				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day I spend time outside the house for	11-14 hours	1	4	12	3	<b>20</b>
	7-10 hours	1	13	43	12	<b>69</b>
	< 7 hours	0	9	22	2	<b>33</b>
<b>Total</b>		<b>2</b>	<b>26</b>	<b>77</b>	<b>17</b>	<b>122</b>

Based on Table 10., although most respondents in Medan Helvetia Sub-District believe in the Covid-19 virus, they still leave their homes every day, which is about 7-10 hours a day. In fact, during the Covid-19 pandemic, people should prioritize activities at home. However, this can be motivated by the occupation of the respondents, many of whom work as entrepreneurs, especially traders. Those who work as traders require themselves to leave the house every day.

**Table 11. In a day, I spend time outside the house as long as \* I have never been exposed to Covid-19 symptoms/disease Crosstabulation**

		I have never had any symptoms/disease of Covid-19				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day I spend time outside the house for	11-14 hours	0	2	16	2	<b>20</b>
	7-10 hours	3	15	46	5	<b>69</b>
	< 7 hours	0	7	24	2	<b>33</b>
<b>Total</b>		<b>3</b>	<b>24</b>	<b>86</b>	<b>9</b>	<b>122</b>

Table 11. shows that most of the respondents in the Medan Helvetia Sub-District felt they had never been exposed to Covid-19 symptoms/diseases. It could become the factors that keep people out of the house every day even though the Covid-19 cases in this sub-district are increasing. Even if you feel you don't have Covid-19 symptoms, it doesn't mean that the virus isn't in your body. Therefore, even if people do not feel symptoms of the Covid-19 disease, they should still minimize their time outside their homes.

**Table 12. In a day I spend time outside the house for \* I have been vaccinated against Covid-19 twice Crosstabulation**

		I have been vaccinated against Covid-19 twice				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day I spend time outside the house for	11-14 hours	0	1	13	6	<b>20</b>
	7-10 hours	2	5	46	16	<b>69</b>
	< 7 hours	0	8	20	5	<b>33</b>
<b>Total</b>		<b>2</b>	<b>14</b>	<b>79</b>	<b>27</b>	<b>122</b>

Table 12. shows that most of the respondents in the Medan Helvetia Sub-District have been vaccinated against Covid-19 twice. Unfortunately, even though they have been vaccinated, people cannot restrain themselves from continuing their activities at home fully. They often leave the house for 7-10 hours every day. The vaccine does not guarantee that a person will not be exposed to the Covid-19 virus. Therefore, even though they have been vaccinated twice, people should still try to refrain from leaving their homes every day.

**Table 13. In a day I spend time outdoors for \* I always maintain a minimum distance of 1 meter from other people, especially in crowds of Crosstabulation**

		I always keep a distance of at least 1 meter from other people, especially in a crowd				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day I spend time outside the house for	11-14 hours	1	3	7	9	<b>20</b>
	7-10 hours	3	21	29	16	<b>69</b>
	< 7 hours	0	12	15	6	<b>33</b>
<b>Total</b>		<b>4</b>	<b>36</b>	<b>51</b>	<b>31</b>	<b>122</b>

Based on Table 13., although most respondents in Medan Helvetia Sub-District always leave their homes daily, they always maintain a minimum distance of 1 meter from other people, especially in crowds. Unfortunately, many respondents admitted that they did not always keep their distance, especially in public. By not implementing maximum physical distancing, the higher the potential for spreading the Covid-19 virus.



**Table 14. In a day I spend time outside the house for \* In my opinion, social distancing is applied in this place Crosstabulation**

		In my opinion, social distancing is applied in this place				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day I spend time outside the house for	11-14 hours	1	3	13	3	<b>20</b>
	7-10 hours	0	22	<b>37</b>	10	<b>69</b>
	< 7 hours	1	12	16	4	<b>33</b>
<b>Total</b>		<b>2</b>	<b>37</b>	<b>66</b>	<b>17</b>	<b>122</b>

Based on Table 14., although most respondents in Medan Helvetia Sub-District leave their homes every day, the places they visit have implemented social distancing to prevent the spread of the Covid-19 virus. Unfortunately, not a few respondents also admitted that social distancing is not implemented in these locations. It indicates that social restriction measures have not been implemented optimally in this research area.

**Table 15. In a day I spend time outdoors for \* In my opinion, this place provides a lot of open space to accommodate community activities Crosstabulation**

		In my opinion, this place provides a lot of open space to accommodate community activities				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day I spend time outside the house for	11-14 hours	1	3	10	6	<b>20</b>
	7-10 hours	0	23	<b>35</b>	11	<b>69</b>
	< 7 hours	0	17	13	3	<b>33</b>
<b>Total</b>		<b>1</b>	<b>43</b>	<b>58</b>	<b>20</b>	<b>122</b>

Table 15. shows that although most of the respondents in the Medan Helvetia Sub-District often leave their homes every day, the locations they visit have begun to provide a lot of open space to accommodate community activities sub-district. Unfortunately, not a few respondents also admitted that the selected sites in this sub-district had not offered a lot of open space in response to the Covid-19 pandemic. It can contribute to the spread of the Covid-19 virus in this sub-district, given that closed areas can be 18.7 times more likely to be a location for Covid-19 transmission than open-air environments.

Based on the crosstabulation results, the researcher concluded that although most people in the Medan Helvetia Sub-District believe in the existence of the Covid-19 virus and have been vaccinated twice, they have not been able to limit their activities outside. It can be seen from the majority of people who often leave the house every day for 7-10 hours. In addition, several other vital steps in dealing with the Covid-19 pandemic, such as the application of physical distancing, social distancing, and activities in open spaces, have not been optimally promoted in the Medan Helvetia Sub-District.

a) In a day, the places I visit are \* Covid-19 Crosstabulation

**Table 16. In a day, I visit as many places as \* I believe in the Covid-19 virus Crosstabulation**

		I believe in the Covid-19 virus				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day the places I visit as many as	5-7 places	1	2	6	2	<b>11</b>
	2-4 places	1	16	<b>50</b>	11	<b>78</b>
	0-1 places	0	8	21	4	<b>33</b>
<b>Total</b>		<b>2</b>	<b>26</b>	<b>77</b>	<b>17</b>	<b>122</b>

Based on Table 16., although most respondents in Medan Helvetia Sub-District believe in the Covid-19 virus, they still leave their homes by visiting 2-4 places daily. However, this can be motivated by the occupation of the respondents, many of whom work as entrepreneurs, especially traders. Those who work as traders must leave their homes every day, especially street vendors who often move from one place to another.

**Table 17. In a day, the places I visit are as many as \* I have never been exposed to the symptoms/disease of Covid-19 Crosstabulation**

		I have never had any symptoms/disease of Covid-19				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day the places I visit as many as	5-7 places	0	1	8	2	<b>11</b>
	2-4 places	3	16	<b>53</b>	6	<b>78</b>
	0-1 places	0	7	25	1	<b>33</b>
<b>Total</b>		<b>3</b>	<b>24</b>	<b>86</b>	<b>9</b>	<b>122</b>

Table 17. shows that most of the respondents in the Medan Helvetia Sub-District felt they had never been exposed to Covid-19 symptoms/diseases. It could be the factor that makes people stay out of the house every day even though the Covid-19 cases in this sub-district are increasing. Even if you feel you don't have Covid-19 symptoms, it doesn't mean that the virus isn't in your body. Therefore, even if people do not feel symptoms of the Covid-19 disease, they should still minimize going to public places.

**Table 18. In a day, the places I visit are \* I have been vaccinated against Covid-19 twice Crosstabulation**

		I have been vaccinated against Covid-19 twice				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day the places I visit as many as	5-7 places	0	0	8	3	<b>11</b>
	2-4 places	2	8	49	19	<b>78</b>
	0-1 places	0	6	22	5	<b>33</b>
<b>Total</b>		<b>2</b>	<b>14</b>	<b>79</b>	<b>27</b>	<b>122</b>

Table 18. shows that most of the respondents in the Medan Helvetia Sub-District have been vaccinated against Covid-19 twice. Unfortunately, even though they have been vaccinated, people cannot restrain themselves from continuing their activities at home fully. It can be seen in the people who often leave the house and visit 2-4 places daily.

**Table 19. In a day, the places I visit are as many as \* In my opinion, physical distancing is applied in this place Crosstabulation**

		In my opinion, physical distancing is applied in this place				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day the places I visit as many as	5-7 places	1	3	6	1	<b>11</b>
	2-4 places	1	26	39	12	<b>78</b>
	0-1 places	0	15	16	2	<b>33</b>
<b>Total</b>		<b>2</b>	<b>44</b>	<b>61</b>	<b>15</b>	<b>122</b>

Based on Table 19., although most respondents in Medan Helvetia Sub-District always visit several places every day, visitors in the places they visit always maintain a minimum distance of 1 meter from

other people, especially in crowds. Unfortunately, not a few respondents also admitted that some visitors did not implement physical distancing. By not implementing maximum physical distancing, the higher the potential for spreading the Covid-19 virus.

**Table 20. In a day, I visit as many places as \* I always avoid crowds during the Covid-19 pandemic Crosstabulation**

		I always avoid crowds during the Covid-19 pandemic				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day the places I visit as many as	5-7 places	2	3	5	1	<b>11</b>
	2-4 places	0	23	<b>38</b>	17	<b>78</b>
	0-1 places	0	5	20	8	<b>33</b>
<b>Total</b>		<b>2</b>	<b>31</b>	<b>63</b>	<b>26</b>	<b>122</b>

Based on Table 20., although most of the respondents in Medan Helvetia Sub-District always leave their homes every day, they always avoid crowds. Unfortunately, not a few respondents admitted that they did not always avoid crowds. It can contribute to an increase in the spread of the Covid-19 virus.

**Table 21. In a day, I visit as many places as \* In my opinion, this place provides a lot of open space to accommodate community activities Crosstabulation**

		In my opinion, this place provides a lot of open space to accommodate community activities				
		Disagree	Less Agree	Agree	Very Agree	Total
In a day the places I visit as many as	5-7 places	1	1	7	2	11
	2-4 places	0	25	37	16	78
	0-1 places	0	17	14	2	33
<b>Total</b>		<b>1</b>	<b>43</b>	<b>58</b>	<b>20</b>	<b>122</b>

Table 21. shows that although most respondents in Medan Helvetia Sub-District often visit several places every day, they have begun to provide a lot of open space to accommodate community activities in this sub-district. Unfortunately, not a few respondents also admitted that the selected locations in this sub-district had not provided a lot of open space in response to the Covid-19 pandemic. It could be one of the contributing factors to the spread of the Covid-19 virus in this sub-district, given that closed spaces can be 18.7 times more likely to be a location for Covid-19 transmission than open-air environments.

Based on the Crosstabulation results, the researcher concluded that although most people in the Medan Helvetia Sub-District believe in the existence of the Covid-19 virus and have been vaccinated twice, they have not been able to limit their activities outside. It can be seen from the majority of people who often visit several places daily, around 2-4 sites. In addition, several other vital steps in dealing with the Covid-19 pandemic, such as the application of physical distancing, social distancing, and activities in open spaces, have not been optimally promoted in the Medan Helvetia Sub-District.

c) The frequency I change places in a day is \* Covid-19 Crosstabulation

**Table 22. The frequency I change places in a day is \* I believe in the Covid-19 virus Crosstabulation**

		I believe in the Covid-19 virus				
		Disagree	Less Agree	Agree	Very Agree	Total
The frequency with which I change places in a day is	Often	1	0	2	1	4
	Less Often	0	11	36	7	54
	Not Often	1	10	21	8	40
	Very Not Often	0	5	18	1	24
<b>Total</b>		<b>2</b>	<b>26</b>	<b>77</b>	<b>17</b>	<b>122</b>

Based on Table 22., most of the respondents in the Medan Helvetia Sub-District believe in the Covid-19 virus, so they do not move frequently. It is a good step toward reducing the spread of the Covid-19 virus.

**Table 23. The frequency with which I change places in a day is \* I have never been exposed to the symptoms/disease of Covid-19 Crosstabulation**

		I have never had any symptoms/disease of Covid-19				
		Disagree	Less Agree	Agree	Very Agree	Total
The frequency with which I change places in a day is	Often	0	1	3	0	4
	Less Often	3	12	36	3	54
	Not Often	0	8	27	5	40
	Very Not Often	0	3	20	1	24
<b>Total</b>		<b>3</b>	<b>24</b>	<b>86</b>	<b>9</b>	<b>122</b>

Based on Table 23., although most of the respondents in Medan Helvetia Sub-District feel they have never been exposed to the symptoms/disease of Covid-19, they still try not to move from place to place often. It is a good step toward reducing the spread of the Covid-19 virus.

**Table 24. The frequency of changing places in a day is \* I have been vaccinated against Covid-19 twice Crosstabulation**

		I have been vaccinated against Covid-19 twice				
		Disagree	Less Agree	Agree	Very Agree	Total
The frequency with which I change places in a day is	Often	0	0	2	2	4
	Less Often	1	3	36	14	54
	Not Often	1	8	22	9	40
	Very Not Often	0	3	19	2	24
<b>Total</b>		<b>2</b>	<b>14</b>	<b>79</b>	<b>27</b>	<b>122</b>

Based on Table 24., although most of the respondents in the Medan Helvetia Sub-District have been vaccinated against Covid-19 twice, they still try not to change places often. It is a good step toward reducing the spread of the Covid-19 virus.

**Table 25. The frequency of changing places in a day is \* I always maintain a minimum distance of 1 meter from other people, especially in crowds of Crosstabulation**

		I always keep a distance of at least 1 meter from other people, especially in a crowd				
		Disagree	Less Agree	Agree	Very Agree	Total
The frequency with which I change places in a day is	Often	1	1	0	2	4
	Less Often	3	12	21	18	54
	Not Often	0	14	16	10	40
	Very Not Often	0	9	14	1	24
<b>Total</b>		<b>4</b>	<b>36</b>	<b>51</b>	<b>31</b>	<b>122</b>



Based on Table 25., most of the respondents in Medan Helvetia Sub-District consistently implement physical distancing and limit the frequency of moving places they do daily. It is a good step toward reducing the spread of the Covid-19 virus.

**Table 26. The frequency of changing places in a day is \* In my opinion, social distancing is applied in this place Crosstabulation**

		In my opinion, social distancing is applied in this place				
		Disagree	Less Agree	Agree	Very Agree	Total
The frequency with which I change places in a day is	Often	0	1	2	1	<b>4</b>
	Less Often	1	16	<b>28</b>	9	<b>54</b>
	Not Often	1	13	23	3	<b>40</b>
	Very Not Often	0	7	13	4	<b>24</b>
<b>Total</b>		<b>2</b>	<b>37</b>	<b>66</b>	<b>17</b>	<b>122</b>

Table 26. shows that most public places in Medan Helvetia Sub-District consistently implement social distancing, and the community always limits the frequency of moving places they do daily. It is a good step toward reducing the spread of the Covid-19 virus.

**Table 27. The frequency of changing places in a day is \* I prioritize activities in open spaces rather than in closed areas during the Covid-19 pandemic Crosstabulation**

		I prefer to be active in an open space than in a closed room during the Covid-19 pandemic				
		Disagree	Less Agree	Agree	Very Agree	Total
The frequency with which I change places in a day is	Often	0	0	3	1	4
	Less Often	3	11	25	15	54
	Not Often	0	13	18	9	40
	Very Not Often	0	12	10	2	24
<b>Total</b>		<b>3</b>	<b>36</b>	<b>56</b>	<b>27</b>	<b>122</b>

Table 27. shows that most of the respondents in Medan Helvetia Sub-District prioritize activities in open spaces and always limit the frequency of moving places they do daily. It is a good step toward reducing the spread of the Covid-19 virus.

Based on the results of the Crosstabulation between the frequency of respondents moving places in a day with Covid-19, the researcher concluded that the frequency of moving locations did not affect the spread of the Covid-19 virus in the Medan Helvetia Sub-District. It can be seen from the displacement frequency, which tends to be less frequent. So from the aspect of movement patterns, what affects the spread of Covid-19 in the Medan Helvetia Sub-District is the time spent outside the home and the places people visit every day.

### CONCLUSION

The structure of urban space is a configuration of urban elements and patterns of community movement. The aspects of the city are formed by the population and the distribution of its activities. So, to examine the effect of spatial structure on the spread of the Covid-19 virus, three indicators are used, namely population density, density profile (activity distribution), and movement patterns. These indicators are associated with the Covid-19 variable to examine the influence on the spread of the Covid-19 virus, especially in the Medan Helvetia Sub-District, as the sub-district with the highest number of Covid-19 cases in Medan City—starting from April to December 2020.

Based on the results of data analysis, we can conclude that two of the three indicators affected the spread of the Covid-19 virus in Medan Helvetia Sub-District, namely hands of population density and movement patterns. The effect of population density on the level of reach of the Covid-19 virus is proven by comparing the population density of the three selected urban villages, namely Helvetia Tengah Village, Tanjung Gusta Village, and Helvetia Timur Village, with the level of spread of the

Covid-19 virus in the three villages. This comparison shows that the higher the population density, the higher the increase in Covid-19 cases in this research location.

The movement pattern influence is tested by distributing questionnaires to 122 respondents in nine locations spread over the three selected villages. The questionnaire results show that the movement of people in the Sub-District of Medan Helvetia is dominated by people who live in the Helvetia Tengah Village. Where this village is the highest increase in the number of Covid-19 cases, it can be concluded that the more people who move to various places every day, the higher the potential for exposure to the Covid-19 virus, which results in the higher the potential for its spread.

In addition, the questionnaire results also show the lack of efforts to prevent the spread of the Covid-19 virus from the community in the Medan Helvetia Sub-District. It shows that most of the respondents still go out every day, even though they believe in the existence of this virus. Moreover, not a few respondents claimed to have not implemented physical distancing and social distancing optimally. In addition, the available open space in this sub-district is considered lacking. Meanwhile, according to the Detailed Spatial Plan for Medan City, Medan Helvetia Sub-District has a percentage of green open space of 28.97%, which weighed less than the minimum portion of 30%. In comparison, the open space can be 18.7 times better in suppressing the spread of the Covid-19 virus. These factors have contributed to making people's movement patterns affect the level of reach of the Covid-19 virus.

Meanwhile, the density profile has not been shown to affect the rate of spread of the Covid-19 virus. It can be seen from the data analysis results showing that the percentage of service center sub-zone area is not directly proportional to the increase in the number of Covid-19 cases. So, even though Helvetia Timur Village has the highest percentage of sub-center service zone area, this sub-district has the lowest increase in the number of Covid-19 cases. Even though the more expansive the sub-zone of the service center, the more community activities occur, which results in a higher potential for crowd creation. However, further research shows that several distributions of actions in the Helvetia Timur Village were dominated by people living in Helvetia Tengah. It causes an inverse comparison between the density profile and the level of spread of the Covid-19 virus in the Medan Helvetia Sub-District.

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### Author Profile



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