AIJR Preprints
Section: Coronavirus
Article Id: 174, Version: 1, 2020
URL: https://preprints.aijr.org/index.php/ap/preprint/view/174
{Click on above link to see the latest available version of this article}

NOT PEER-REVIEWED

Version 1: Received: 18 July 2020 / Approved: 22 July 2020 / Online: 24 July 2020

The Trend Distribution and Temporal Pattern Analysis of COVID-19 Pandemic using GIS framework in Malaysia

Mohd Sahrul Syukri Yahya*, Edie Ezwan Mohd Safian, Burhaida Burhan

Department of Real Estate Management, Faculty of Technology Management and Business, Universiti Tun Hussein Onn Malaysia (UTHM), 86400 Parit Raja, Batu Pahat, Johor

*Corresponding author's email: **********

ABSTRACT

Currently, the most severe infectious disease was the new coronavirus disease (COVID-19) in all countries in 2019 and 2020. At the end of December 2019, in Wuhan, China, there was an international cluster of cases involving Novel Coronavirus pneumonia (SARS-COV-2). The worldwide number of active cases and deaths is rising, especially in the top countries such as the United States (U.S), Brazil, and India. In Malaysia, these cases of COVID-19 have significantly decreased the number of active infections and deaths in May and June 2020. COVID-19 has had a significant effect on human life, socio-economic growth, and public relation. It is aimed at senior groups and individuals with various health conditions such as cancer, respiratory problems, diabetes, hypertension, and heart-related issues. The World Health Organization (WHO) has formally declared COVID-19 as an international emergency case. As a result, Kuala Lumpur was the most affected state in Malaysia as of 12 July 2020, followed by Selangor, Negeri Sembilan, and Johor. Regardless of the infection chain ratio, the favorable cases in each affected state of Malaysia are rising every day. The Malaysian Government attempted to split the infection chain ratio affected by COVID-19 via the lockdown definition. The research aims to use GIS software to analyze COVID-19's spatial trend distribution and temporal pattern analysis for human health. Geographic information systems (GIS) technologies have played a significant role in spatial information, spatial tracking of confirmed cases, active case, death, and discharge cases, and predicting the magnitude of the spread. Monitoring, evaluating, and planning using geospatial analysis are essential for controlling the spread of COVID-19 within the country.

Keywords: COVID-19, Pattern Analysis, GIS, Lockdown, World Health Organization (WHO)

1 Introduction

A new outbreak of the recent so-called Coronavirus Disease (COVID-19) was the latest threat to global health attention. In December 2019, Covid-19 was approved. On January 2020 the COVID-19, a new and possible corona viral disease that has begun in Wuhan City, Hubei province's capital city in China, and has rapidly spread out in China and beyond, is a response and an outbreak of an emerging disease (Zhu et al., 2019; Jiang et al., 2020; Ma et al., 2020). Yang et al., 2020 mentioned that in February 2020, the COVID 19 situation reports 77 780 cases reported in China, released by the World Health Organization (WHO). The WHO declared the outbreak of the COVID-19 as a pandemic on 12 March 2020. The COVID-19 space

How to Cite:

Yahya *et al.* "The Trend Distribution and Temporal Pattern Analysis of COVID-19 Pandemic using GIS framework in Malaysia". *AIJR Preprints*, 174, version 1, 2020.

distribution is high, with overall fatalities of around 3.18 percent and regeneration rates of 63.92 percent (WHO, 2020). As of 12 July 2020, the United States is currently facing the COVID-19 wave of more than 3,356,242 cases (WHO, 2020). Since COVID-19 exists, the virus has quickly spread to many countries throughout China and now, including Brazil, Italy, and India. As a result, COVID-19 has now been recognized worldwide, although in the USA, Brazil, India, and others, the most high-level cases are registered. In Malaysia, the update latest cases on 12 July 2020 reported 8,718 confirmed cases, 8,519 discharged patients, 77 patients in the treatment condition, and 122 deaths (MOH, 2020). The confirmed cases are divided and categorized into six groups of clusters; Tabligh (3,375 cases), Pedas (249 cases), Church (191 cases), Case 26 (121 cases), Wedding (96 cases) and RK family from Italy (65 cases). All these clusters contribute to the increase of COVID-19 cases in Malaysia. As we know, COVID-19 is a respiratory infection transmitted by animals or from an infected individual to another by zoonotic (Li et al., 2020; Mackenzie & Smith, 2020). It means that the contact mode involves the air gon infected person sneezing or coughing, touching surfaces or objects (e.g., doorknobs or tables) susceptible to the virus. When someone speaks, it can spread by breathing within 1 meter of a person with COVID-19 infection (K et al., 2020; Kumar et al., 2020). He/she was then using the same hand to touch his mouth, nose, and eyes, without washing his hands with alcohol-based soap sanitizing under running water. No vaccine and no specific antivirus medicine to prevent or treat COVID-19, but some traditional methods or remedies may provide comfort.

Several studies performed a temporal analysis of COVID-19 at several periods, discuss mortality, population distribution, and disease patients using GIS. This study was conducted to relate the demography and status of patients who died, such as type of clusters, chronic disease, and transmission. GIS application is used to show the trend and distribution analysis of COVID-19 in India. The outcome is high rate confirmed cases and death. No specific antibiotics or treatment options are available for COVID-19 (Murugesan et al., 2020). Therefore, GIS is the most effective method for performing spatial analysis of COVID 19 contaminated areas (Franch-Pardo et al., 2020). The most effective method in performing spatial analyzes in the COVID 19 contaminated sites is the geographical information systems (GIS). This article will help society and researchers map and categorize the GIS services into high, medium, and low-risk zones spatially. This scenario is similar to Ghana's country using GIS to identify high-low risks area and predict the COVID-19 distribution (Mo et al., 2020; Sarfo & Karuppannan, 2020). The report will also show a wise analysis of changes in COVID-19 cases from February until the end of June, including positive or confirmed cases, active cases, and retrieved cases and death. GIS can be a vital tool for educating, preventing, and treating the deadly disease. The severity of the disease in each infected area and its intensity of propagation can be identified by analyzing spatial information, which ultimately contributes to targeting the hotspots. This paper aims to spatially map affected areas to demonstrate an evolution of COVID-19 to take preventive measures and demonstrate functional recovery from this infectious disease to states and regions. Therefore, this study aims to detect space-time patterns of COVID-19 by using spatiotemporal methodologies, specifically descriptive statistical tests and ArcGIS 10.5 spatial autocorrelation indexes. In Malaysia, the focus region of the analysis also influenced space-time trends at the state-district level. In China, this study also established the temporal, geographic trends of the COVID-19 at towns, provinces, and countries and analyzed the infection's evolving trends (Tang et al., 2020).

2 Statement of the Problem

COVID-19 is an epidemic and a significant threat to public health. About 12,860,921 cases, 568,501 deaths, and 7,489,341 recovered worldwide were confirmed by 12 July 2020. Global expansion was rapid, with at least one case now recorded by 146 countries. COVID-19 is the largest and most dangerous disease cluster observed in the world in all outbreaks. COVID-19 is becoming a global crisis, in which the planet has collapsed, and death from this epidemic is gravitational. With almost 150 countries now, the worldwide spread has been substantial, and at least one case has been identified. Although the disease continues to spread despite aggressive containment efforts, the number of sufferers is growing. WHO (2020) reported

Americas has recorded the largest number of cases (7,154,840) followed by Europe (3,008,972), Eastern Mediterranean (1,346,982), Southeast Asia (1,308,441), Africa (543,122) and Western Pacific (253,495). Nowadays, for all the leading nations, politics, and religions, this issue is becoming a nightmare of daring difficulties. Consequently, this study aims to assess COVID-19 spatial distribution and descriptive statistics (age, sex, clusters, population density, chronic diseases, and transmissions). This study refers to Likassa (2020) that expressed using descriptive statistics to evaluate the impacts of seven variables such as age, sex, blood type, previous healthy history, transmission types, and location.

3 Methodology

3.1 Study area and period

This research was carried out in Malaysia and located in Southeast Asia. Malaysia's total land area is 329,758 km2: 131,598 km2 in Peninsular Malaysia and 198,160 km2 in Sabah and Sarawak. Temperatures and precipitation vary according to elevation and sea proximity. The average annual temperatures ranged from 23oC to 34oC, however, appeared to be consistent throughout the year. Rainfall is heavy from April to October, with annual Southwestern monsoons and October to February with northeastern monsoons. The total annual precipitation in East Malaysia varies from 1,300 to 4,700 mm and 1,400 to 4,000 mm in the Peninsula. The moisture level is also high; the average moisture ranges between 80 and 90%. Malaysia is a big concern that the spread of the virus in March until June 2020. It takes all states and districts in Malaysia. Besides, each state reports the number of confirmed cases recoveries and deaths of the COVID-19 pandemic. The monitoring period covers details from the virus outbreak until 12 July 2020. The 12 leading public hospitals, five public laboratories, and 1 Institute for Medical Research (IMR) were diagnosed and confirmed cases (Figure 1). The change in parameters will lead to spatial and temporal pattern differences in the majority of areas.

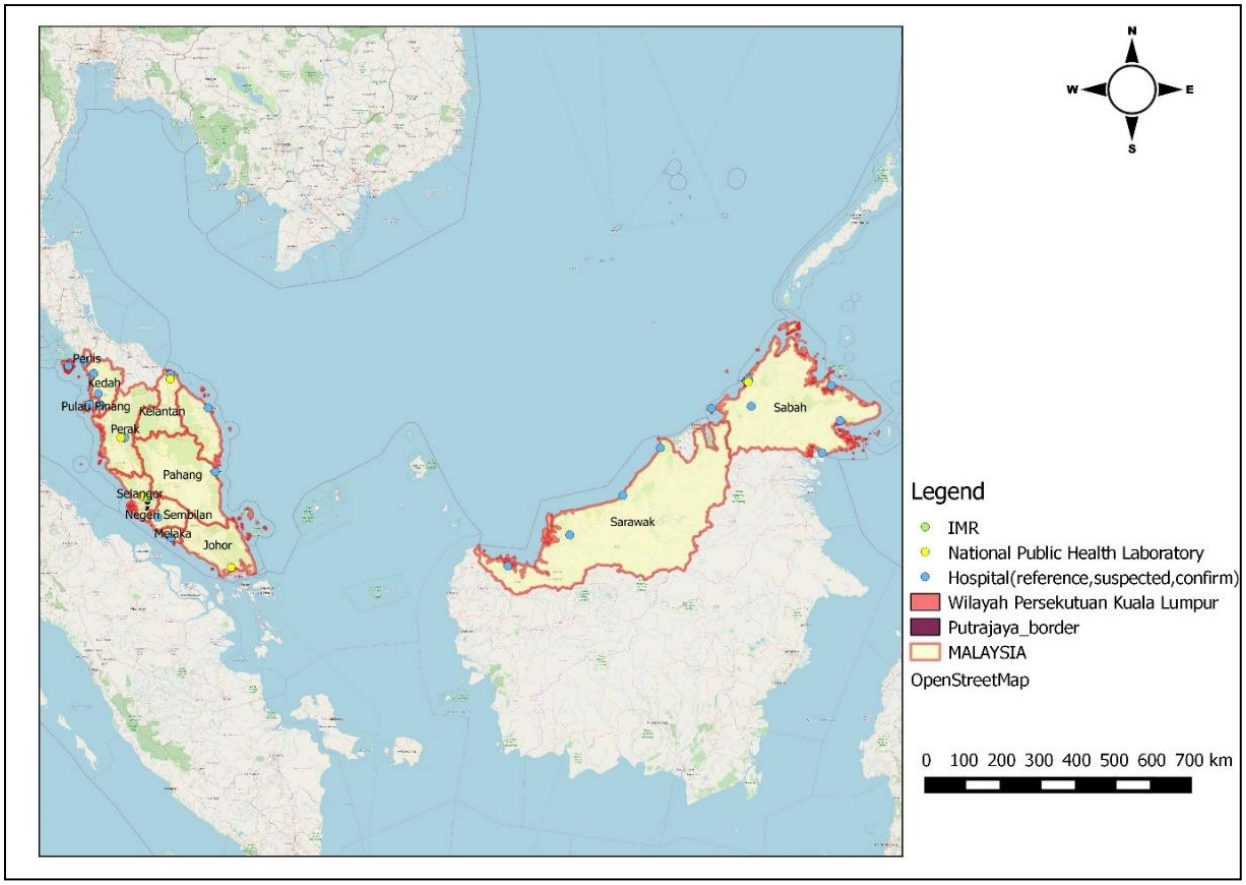

Figure 1: The location of study cases, Hospital, IMR and Laboratory in Malaysia

3.2 Source of the dataset

The data included in this study includes all information reported by the World Health Organization from the start of 27 February 2020. This report also considers all continents, countries, and territories. In the present report, the COVID-19 verified cases and deaths due to COVID-19 shall be considered along with the transmission method. Besides, in Malaysia, the specific details of the information collected from the Ministry of Health (MOH) are related to COVID-19 patients such as age, sex, type of clusters, and death date. The MOH directly collects these cases and reports every day on the local government and the media website. COVID-19's high death rate is more linked to the age group over 50, male and chronic diseases becoming more vulnerable. Patients of COVID-19 aged more are more vulnerable to death than any age group relative to the other age group. The total population obtained from Census 2010 as a reference by the Department of Statistics Malaysia (DOSM).

3.3 Analysis Methods

During the analytic process, the original data was calculated using MS Excel 2013 (Microsoft) and the Social Science Statistics Package (SPSS). The data collected were translated into GIS by ArcGIS version 10.5. The gradient of five colors to determine high and low rate cases using from yellow to dark brown.

4 Results and Discussion

The dataset obtained from 27 February until 22 June 2020 for the current study. This problem is because of the start case of COVID-19 in Malaysia from 27 February by China tourists who came to visit Malaysia. The actual number cases a 12 July 2020, as shown in Table 1. Then, the confirmed cases are high risks in April and a slight decrease in May and June. Kuala Lumpur, Selangor, Johor, and Sarawak reported the most risks of COVID-19 in Malaysia because these states have populated areas. On 12 July 2020, Selangor still indicated 64 or 65% of active cases in Malaysia.

Table 1: The number of cases from 27 February until 22 June 2020 and number active cases by state

State	27/02/2020-31/03/2020	1/4/2020-30/04/2020	1/5/2020-31/5/2020	1/06/2020-22/6/2020	Number active cases(12/07/2020)
Selangor	704	727	447	115	64
Johor	349	314	12	14	7
WP Kuala Lumpur	430	802	796	402	7
Perlis	12	6	0	0	0
Kedah	77	18	1	0	1
Penang	94	27	0	0	0
Negeri Sembilan	181	332	345	157	1
Pahang	102	90	67	4	0
Sabah	206	109	31	20	6
Sarawak	156	351	45	18	9
WP Labuan	10	6	0	1	0
Putrajaya	26	55	16	0	1
Kelantan	131	24	1	1	0
Terengganu	47	63	1	0	0
Melaka	52	146	21	37	2
Perak	189	64	3	2	0
total	2766	3134	1786	771	98

(Source: Ministry of Health, 2020)

Table 2 shows the relationship between the number of population and cases in Malaysia. The statistics summary indicated that most population area has influenced and contribute to COVID-19 cases. The populated area, mostly in an urban area compared to the rural area. In Table 2, as per the census 2010, Selangor was on the top of highly populated states followed by Johor and Penang.

Table 2: The number of cases and population by administrative district

No.	District	Total	Cases (updated 12/07/2020)	No.	District	Total	Cases (updated 12/07/2020)
1	Batu Pahat	401,902	53	73	Sandakan	396,290	22
2	Johor Bahru	1,334,188	242	74	Kinabatangan	146,987	23
3	Kluang	288,364	224	75	Beluran	104,484	1
4	Kota Tinggi	187,824	27	76	Kota Kinabalu	452,058	69
5	Mersing	69,028	4	77	Ranau	94,092	5
6	Muar	239,027	52	78	Kota Belud	91,272	6
7	Pontian	149,938	18	79	Tuaran	102,411	30
8	Segamat	182,985	19	80	Penampang	121,934	16
9	Kulaijaya	245,294	45	81	Papar	124,420	5
10	Ledang	131,890	15	82	Kudat	83,140	0
11	Baling	132,304	1	83	Kota Marudu	66,374	1
12	Bandar Baharu	41,352	1	84	Pitas	37,808	1
13	Kota Setar	357,176	28	85	Beaufort	64,350	14
14	Kuala Muda	443,488	35	86	Kuala Penyu	18,958	0
15	Kubang Pasu	214,479	9	87	Sipitang	34,862	4
16	Kulim	281,260	13	88	Tenom	55,553	0
17	Langkawi	92,784	4	89	Nabawan	31,807	2
18	Padang Terap	61,970	1	90	Keningau	173,103	20
19	Sik	66,387	1	91	Tambunan	35,667	3
20	Yan	66,606	0	92	Kunak	61,094	8
21	Pendang	93,598	3	93	Tongod	35,341	0
22	Pokok Sena	48,347	0	94	Putatan	54,733	9
23	Bachok	126,350	11	95	Kuching	598,617	345
24	Kota Bharu	468,438	90	96	Bau	52,760	5
25	Machang	89,118	0	97	Lundu	32,568	1
26	Pasir Mas	180,878	11	98	Samarahan	85,495	111
27	Pasir Puteh	113,191	8	99	Serian	89,078	24
28	Tanah Merah	115,949	7	100	Simunjan	38,324	0
29	Tumpat	147,179	13	101	Sri Aman	64,500	3
30	Gua Musang	86,189	2	102	Lubok Antu	27,363	0
31	Kuala Krai	104,234	12	103	Betong	60,728	16
32	Jeli	39,170	2	104	Saratok	45,015	0
33	Alor Gajah	173,712	32	105	Sarikei	56,228	6
34	Jasin	131,539	76	106	Maradong	28,713	0
35	Melaka Tengah	484,885	61	107	Daro	29,975	0
36	Jelebu	38,299	2	108	Julau	15,449	0
37	Kuala Pilah	63,874	8	109	Sibu	240,165	9
38	Port Dickson	110,991	13	110	Dalat	18,523	0
39	Rembau	41,988	372	111	Mukah	41,481	3
40	Seremban	536,147	380	112	Kanowit	28,259	0
41	Tampin	82,165	20	113	Bintulu	183,402	23
42	Jempol	112,740	16	114	Tatau	29,592	0
43	Bentong	114,397	25	115	Kapit	55,304	0

44	Cameron Highlands	36,978	4	116	Song	20,105	0
45	Jerantut	88,035	90	117	Belaga	35,247	0
46	Kuantan	443,796	145	118	Miri	290,274	23
47	Lipis	86,484	10	119	Marudi	62,883	0
48	Pekan	105,587	24	120	Limbang	46,980	10
49	Raub	91,731	4	121	Lawas	37,212	0
50	Temerloh	158,724	23	122	Matu	16,952	0
51	Rompin	109,848	6	123	Asajaya	31,190	0
52	Maran	111,056	15	124	Pakan	15,139	0
53	Bera	94,105	19	125	Selangau	22,318	0
54	Batang Padang	175,318	4	126	Gombak	668,694	260
55	Manjung	227,071	25	127	Klang	842,146	190
56	Kinta	749,474	97	128	Kuala Langat	220,214	64
57	Kerian	176,975	19	129	Kuala Selangor	205,257	69
58	Kuala Kangsar	155,592	4	130	Petaling	1,765,495	437
59	Larut dan Matang	326,476	19	131	Sabak Bernam	103,709	30
60	Hilir Perak	202,593	58	132	Sepang	207,354	164
61	Ulu Perak	89,926	6	133	Ulu Langat	1,138,198	631
62	Perak Tengah	99,854	11	134	Ulu Selangor	194,387	77
63	Kampar	96,303	2	135	Besut	136,563	35
64	Perlis	225,630	18	136	Dungun	149,851	38
65	Seberang Perai Tengah	362,820	36	137	Kemaman	166,750	6
66	Seberang Perai Utara	288,692	25	138	Kuala Terengganu	337,553	18
67	Seberang Perai Selatan	166,685	11	139	Marang	95,283	2
68	Timur Laut	510,996	32	140	Hulu Terengganu	70,800	0
69	Barat Daya	197,131	13	141	Setiu	54,563	8
70	Tawau	397,673	88	142	W.P. Labuan	83,920	17
71	Lahad Datu	199,830	48	143	W.P. Putrajaya	68,361	98
72	Semporna	133,164	5	144	W.P. Kuala Lumpur	1,588,750	2,445

(Source: Department of Statistics Malaysia, 2010, Ministry of Health, 2020)

4.1 Identifying the Temporal Patterns of Confirmed cases based on State and District

As a 12 July 2020, according to Table 1 and Figure 2, the high rate areas of confirmed cases at Selangor and Kuala Lumpur are between 1664 to 2076 cases. It cases followed by an average rate from Negeri Sembilan, Johor, and Sarawak at a low rate. Kuala Lumpur, Selangor, Johor, and Sarawak are a highly-populated area. In this situation, we can conclude that the most populated area becomes exposed to the spread of COVID-19.

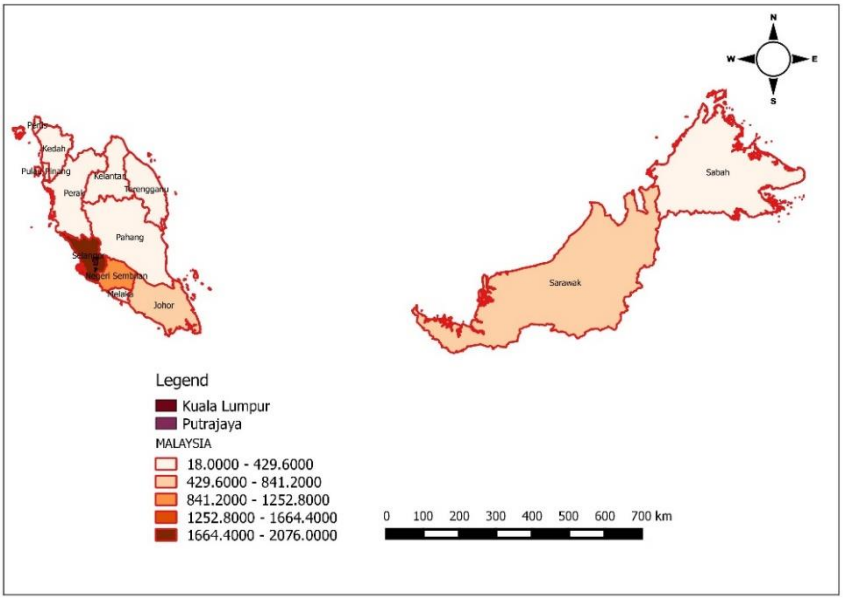

Figure 2: Temporal trends of the confirmed cases (state)

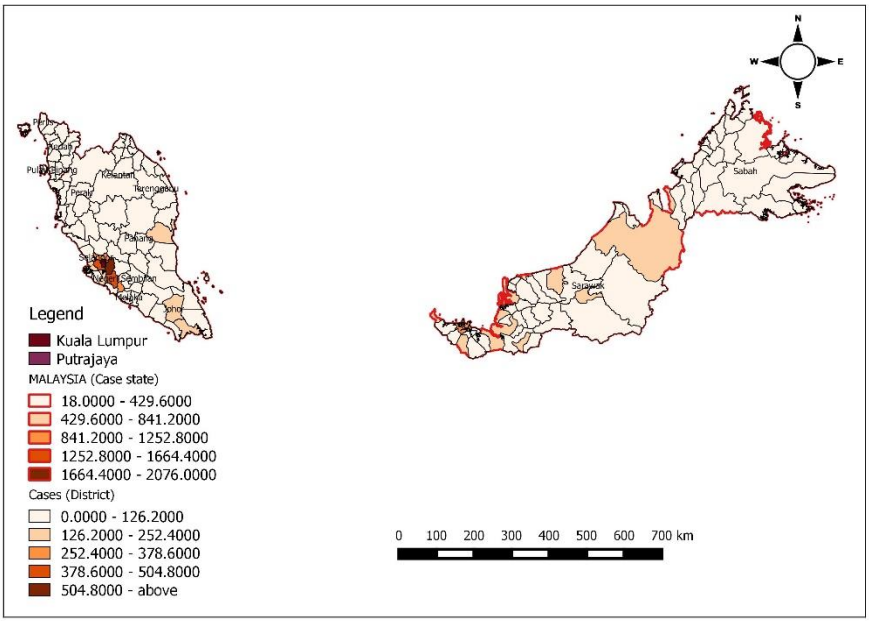

Figure 3: Temporal Trends of the confirmed cases (district)

4.2 Temporal Pattern of Confirmed Cases from 27 February 2020 until 22 June 2020

From 27 February until 31 March 2020, the significant rate cases of COVID-19 were detected in Selangor and Klang Valley area (Figure 4). Johor state is considered an average rate, and four states (Perak, Negeri Sembilan, Sabah, and Sarawak) reported low categories of cases. The rest region still deficient condition.

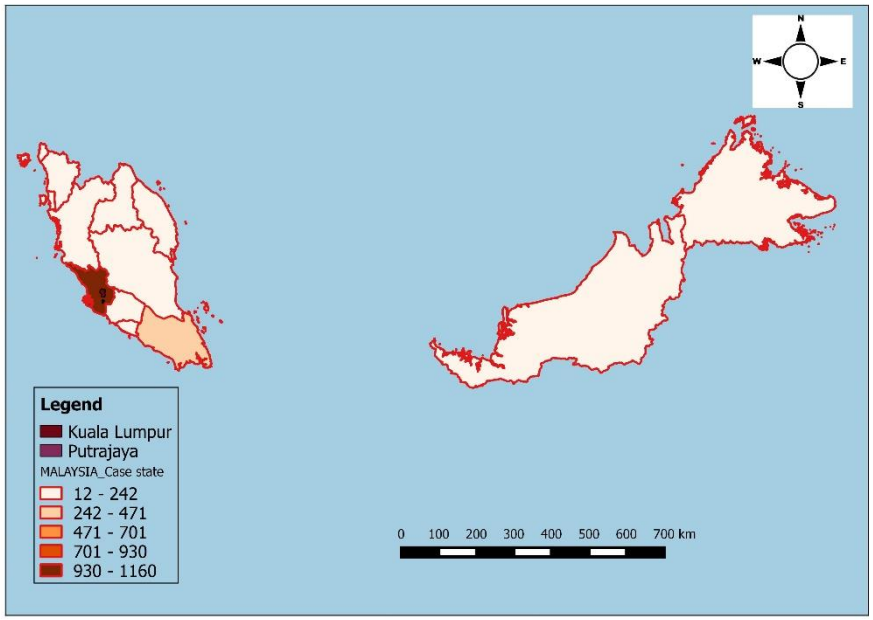

Figure 4: Spatial Distribution of confirmed cases 27 February – 31 March

The second stage of COVID-19 infection on 1 April until 30 April had increased more than March cases (Table 5). Klang Valley area included Kuala Lumpur and Selangor area still in very high rate cases in Malaysia, followed by the nearest state Negeri Sembilan, Johor, and one from Borneo (Sarawak).

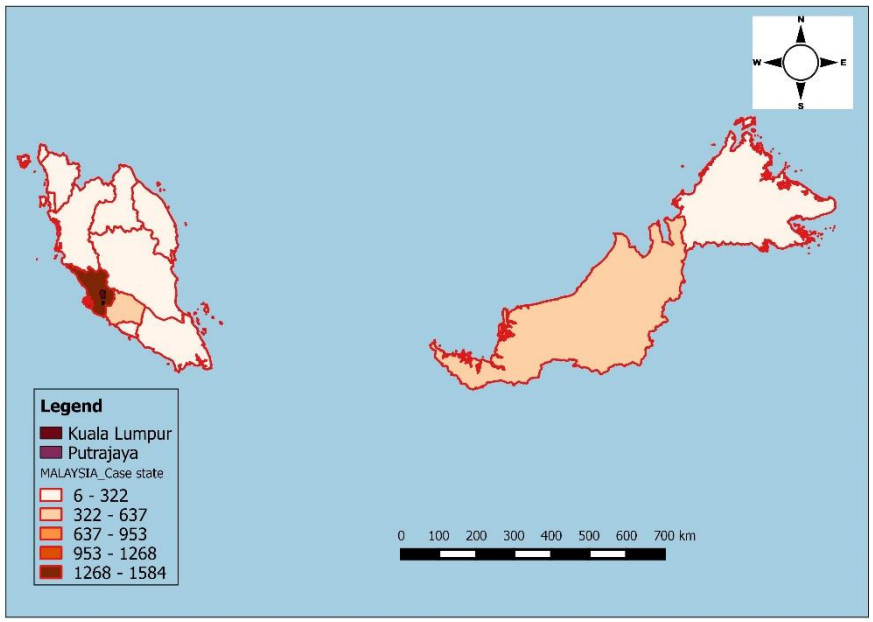

Figure 5: Spatial Distribution of confirmed cases 1 April – 30 April

Figure 5 shows that spatial distribution for confirmed cases from 1 May until 31 May indicated slowly decrease rate cases in Malaysia. A total of cases are 1786 cases, which is Selangor, and Kuala Lumpur maintains a very high rate of COVID-19 cases. Negeri Sembilan has 268 to 358 confirmed cases. We can conclude that Malaysia's closest neighbor of state helps spread COVID-19 infection.

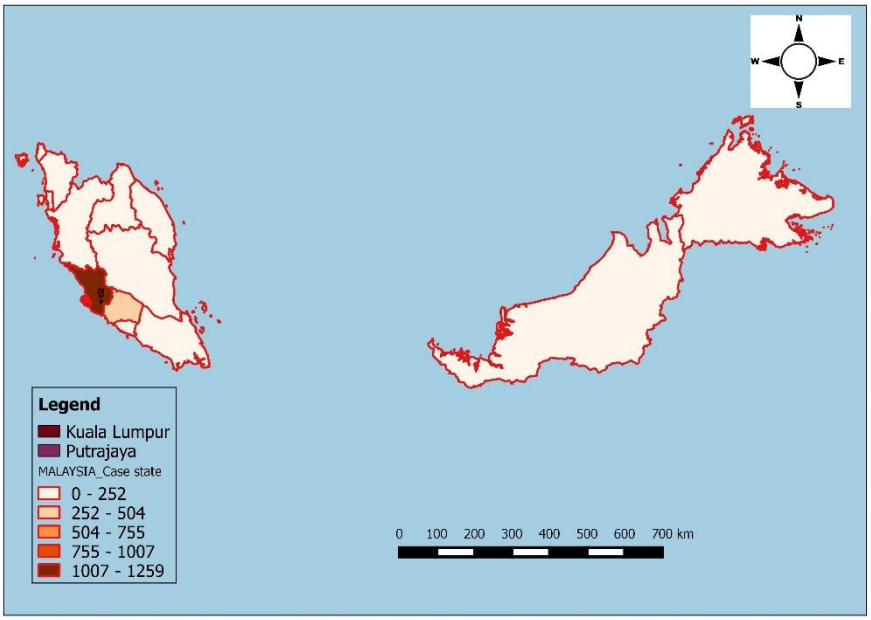

Figure 5: Spatial Distribution of confirmed cases 1 May – 31 May

As a capital city in Malaysia, Kuala Lumpur is still under review for COVID-19 infection because of too many migrant or foreign workers and some tourists. This situation occurs in Negeri Sembilan, especially Rembau District, as shown in Figure 6. The reduction of the total confirmed cases in Malaysia Government Malaysian was announced lockdowns stage by stage. Movement Control Order (MCO), Conditional Movement Control Order (CMCO), and Recovery Movement Control Order (RMCO) are the initiatives to close all supermarkets, schools and universities, hotels and restaurants, Public and Private sectors to work at home via online. This situation was taken to all countries such as China announced lockdown and closed schools, hotels, restaurants, and urban public transport (Xie *et al.,* 2020).

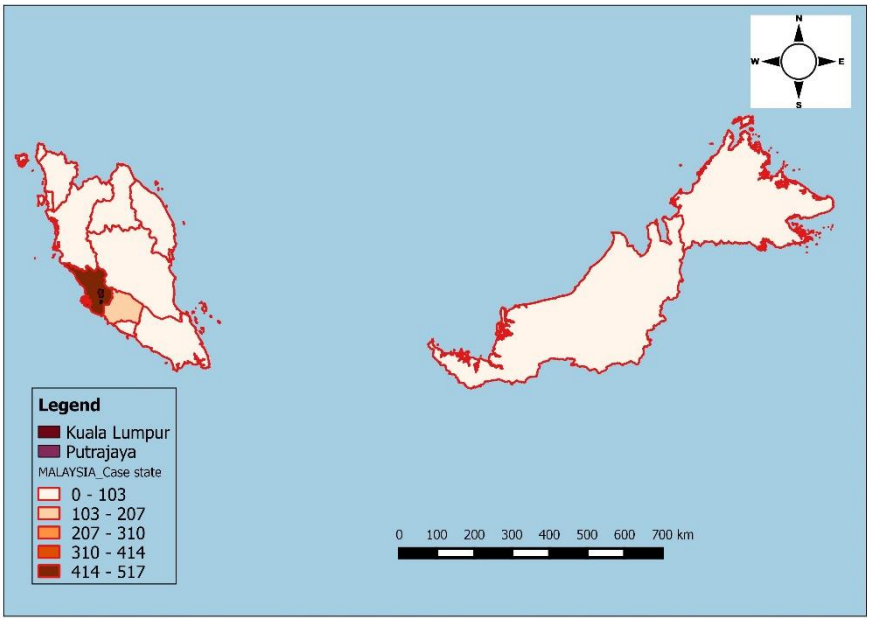

Figure 6: Spatial Distribution confirmed cases 1 June – 22 June

The descriptive statistical analysis in table 3 shows an average of 546 total COVID-19 cases, eight deaths, 535 recoveries, and six active cases per day as per the present scenario. This growth rate in total COVID 19 cases is a dangerous disease to the citizens of Malaysia and its economy and social human being.

Table 3: Descriptive statistics of COVID-19 pandemic in Malaysia by cases, deaths, recoveries and active cases

Items	Total cases	Deaths	Recoveries	Active cases
State	16	16	16	16
Mean	545.88	7.63	535.25	5.81
Median	258.00	5.50	252.00	1.00
Mode	258	1	96[a]	0
Std. Deviation	729.080	7.890	719.825	14.068
Variance	531558.250	62.250	518148.467	197.896
Skewness	1.955	1.026	1.972	3.628
Std. Error of Skewness	.564	.564	.564	.564
Kurtosis	3.063	-.337	3.127	13.783
Std. Error of Kurtosis	1.091	1.091	1.091	1.091
Minimum	17	0	16	0
Maximum	2447	24	2422	57
Sum	8734	122	8564	93

In this situation, doctors are playing a crucial role during the COVID-19 pandemic by treating infected patients. The result shows that a high recovery rate and a low death rate in Malaysia indicate better medical facilities and hospitals with a suitable patient and doctor ratio. Malaysian Government took action when recall retired professional doctors from local and international to serve and combat the COVID-19 pandemic. The low rate of active cases in Malaysia contributes well to human development and economic recovery.

COVID-19 pandemic was conducted by using SPSS to assess the death's status on age, gender, chronic disease, clusters, and transmission. The results of Table 4 has reflected more than 60 years pass away from this infection. In this case, 93 patients from male, and most of them had a chronic disease after post mortem medical checkup. Tabligh from Masjid Sri Petaling has 19 died, followed by RK family from Italy and Church clusters from Kuching. However, other clusters were recorded highly died, about 78%. The majority of the transmission of COVID-19 is due to local transmission followed by undisclosed, imported, and under investigation.

Table 4: Descriptive statistics on age, gender, chronic disease, clusters and transmission

Items		Frequency	Percent
Age	20-39	10	8.2
	40-59	27	22.1
	60 and above	84	68.9
	Not Stated	1	.8
	Total	122	100.0
Gender	Male	93	76.2
	Female	29	23.8
	Total	122	100.0
Chronic Disease	Yes	83	68

	No	39	32
	Total	122	100.0
Cluster	Tabligh	19	15.6
	Church	3	2.5
	RK Family/Italy	5	4.1
	Others	95	77.9
	Total	122	100.0
Transmission	Local	65	54.1
	Undisclosed	51	41.8
	Imported	4	3.3
	Under Investigation	1	0.8
	Total	122	100.0

The summary of Table 5 reported the significant signs and symptoms obtained from clinical studies and its characteristics of COVID-19 from which we can note that significant signs and symptoms are a reasonable condition such as fever, coughs, and breathing problems. Other symptoms such as diabetes, hypertension, heart disease, kidney disease, cancer, gout, stroke, and low immunity in the body are the chronic symptoms of disease patients of COVID-19.

Table 5: The summary of disease patients of COVID-19

Suffered		**Frequency**	**Percent**
	Normal symptom	39	32.0
	Diabetes	4	3.3
	Hypertension	8	6.6
	Heart disease	6	4.9
	Kidney Disease	1	.8
	Diabetes,hypertension,heart disease,kidney disease	3	2.5
	Diabetes,kidney	1	.8
	Diabetes,hypertension,kidney disease	9	7.4
	diabetes,hypertension,liver cancer	1	.8
	diabetes,liver cancer	1	.8
	hypertension,heart disease	4	3.3
	cancer	2	1.6
	cancer,hypertension	2	1.6
	diabetes,hypertension,stroke	1	.8

	diabetes,hypertension,heart disease,stroke	1	.8
	diabetes,hypertension	11	9.0
	hypertension,stroke	1	.8
	Severe Acute Respiratory Infection (SARI)	1	.8
	diabetes, hypertension dan dementia.	2	1.6
	heart disease,hypertension,kidney disease	1	.8
	heart,kidney disease	1	.8
	diabetes,hypertension,heart disease	4	3.3
	diabetes,hypertension,gout	1	.8
	autoimmune disease and other chronic diseases	1	.8
	thyroid	1	.8
	chronic illness and had low immunity	1	.8
	diabetes, high blood pressure and kidney disease	3	2.5
	high blood pressure	1	.8
	chronic illness	5	4.1
	hypertension, autoimmune and thyroid	2	1.6
	diabetes,heart disease	1	.8
	hypertension,gout	1	.8
	hypertension and chronic respiratory disease	1	.8
	Total	122	100.0

4.3 Current status

The world COVID-19 cases mentioned that 13,788,300 confirmed cases and total deaths increase by 589,688 cases. COVID-19 Pandemic cases in Malaysia are well over 8,718 as of 12th July 2020. This pandemic confirms about 1.4% of deaths and 97.6% discharged from the hospital. The first tragedy reported by Malaysia in Kuala Lumpur and Selangor from China tourists. In March, the worldwide number of recorded cases increased, primarily due to individuals traveling to the affected areas. The total number of cases confirmed recently rapidly between March and April. In March, the confirmed cases are 2,766 cases and increase to 3,134 cases in April. Selangor's most active cases followed by Kuala Lumpur and Johor.

5 Conclusions

This study used spatial and time analyses in Malaysia to detect COVID-19 spatiotemporal patterns. The spatial data patterns of the scenario from 27 February until 12 July 2020. Geospatial technologies are a tool to illustrate the trend distribution and pattern of COVID-19 infection. The evaluation of the change in the number of cases with different states and districts is performed. Selangor and Kuala Lumpur were the profoundly affected state. As a 12 July 2020, more than 200 cases in high hotspot dangerous involve 8 districts; Kuala Lumpur, Johor Bahru, Kuching, Gombak, Petaling, Ulu Langat, Rembau and Kluang. IDW was statistical for interpolation maps to help the disease spread rapidly compared to the initial months. As per the spatial, temporal change distribution of COVID-19 analysis, it will be helpful to take the government's necessary steps to monitor and predict the potential distribution of COVID-19infection in the most affected areas. The Standard Operation Procedure (SOP) was announced and implemented by Government Malaysia to prevent and combat COVID-19 Pandemic. The enforcement by the National Security Council of Malaysia (Ministry of Home Affairs) about MCO, CMCO, and RMCO is the best control for COVID-19. It is possible to prevent the ability to diagnose and control the population's movement and the outbreak of the pandemic. The advice of WHO and MOH must be followed to protect and stay healthy from the spread of COVID-19 pandemic.

6 Declarations

6.1 Acknowledgements

Mohd Sahrul Syukri Yahya researched, wrote, methodology, analysed data and revised the article. Dr. Edie Ezwan Mohd Safian contributes on conceptualized the central research idea and provided the theoretical framework, designed the research, supervised research progress. Dr. Edie Ezwan, and Dr. Burhaida Burhan anchored the review, revisions and approved the article submission.

6.2 Competing Interests

The authors declared that no conflict of interest exist in this publication.

References

DOSM (Department of Statistics Malaysia). (2011). Population Distribution and Basic Demographic Characteristic Report 2010.

Franch-Pardo, I., Napoletano, B. M., Rosete-Verges, F., & Billa, L. (2020). Spatial analysis and GIS in the study of COVID-19. A review. *Science of the Total Environment*, *739*. https://doi.org/10.1016/j.scitotenv.2020.140033

Jiang, S., Shi, Z., Shu, Y., Song, J., Gao, G. F., Tan, W., & Guo, D. (2020, March 21). A distinct name is needed for the new coronavirus. *The Lancet*. Lancet Publishing Group. https://doi.org/10.1016/S0140-6736(20)30419-0

K, R. (2020). Application of GIS in COVID -19 Monitoring and Surveillance. *International Journal for Research in Applied Science and Engineering Technology*, *8*(5), 1435–1440. https://doi.org/10.22214/ijraset.2020.5231

Kumar, K., Saho, S., Bharti, B. K., & Walker, S. (2020). Spatial distribution and impact assessment of COVID-19 on human health using geospatial technologies in India. *International Journal of Multidisciplinary Research and Development, 7(5),* 57 – 64.

Li, Q., Guan, X., Wu, P., Wang, X., Zhou, L., Tong, Y., Ren, R., Leung, K., Lau, E.S., Wong, J.Y., Xing, X., Xiang, N., Wu, Y., Li, C., Chen, Q., Li, D., Liu, T., Zhao, J., Li, M., Tu, W., Chen, C., Jin, L., Yang, R., Wang, Q., Zhou, S., Wang, R., Liu, H., Luo, Y., Liu, Y., Shao, G., Li, H., Tao, Z., Yang, Y., Deng, Z., Liu, B., Ma, Z., Zhang, Y., Shi, G., Lam, T.T., Wu, J.T., Gao, G.F., Cowling, B.J., Yang, B., Leung, G.M., & Feng, Z. (2020). Early Transmission Dynamics in Wuhan, China, of Novel Coronavirus–Infected Pneumonia. *The New England Journal of Medicine*, *382*, 1199 - 1207.

Likassa, H. T. (2020). The Impacts of Covariates on Spatial Distribution of CORONA Virus 2019 (COVID-19): WHO Data through Multivariate Analysis of Covariance (MANCOVA). *Eurasian Journal of Medicine and Oncology*. https://doi.org/10.14744/ejmo.2019.81104

Ma, X.; Wang, D.; Xu, W, G.; Gao, F; Tan, W., (2019). A novel coronavirus from patients with pneumonia in China. N. Engl. J. Med., A brief report. Massachusetts Medical Society.

Mackenzie, J.S., & Smith, D.W. (2020). COVID-19: a novel zoonotic disease caused by a coronavirus from China: what we know and what we don't. *Microbiology Australia*.

MOH (Ministry of Health). (2020). The Current Situation of COVID-19 Pandemic in Malaysia. Ministry of Health for Malaysia. http://covid-19.moh.gov.my/

Mo, C., Tan, D., Mai, T., Bei, C., Qin, J., Pang, W., & Zhang, Z. (2020). An analysis of spatiotemporal pattern for COIVD-19 in China based on space-time cube. *Journal of Medical Virology*. https://doi.org/10.1002/jmv.25834

Murugesan, B., Karuppannan, S., Mengistie, A. T., Ranganathan, M., & Gopalakrishnan, G. (2020). Distribution and Trend Analysis of COVID-19 in India: Geospatial Approach. *Journal of Geographical Studies*, 1–9. https://doi.org/10.21523/gcj5.20040101

Sarfo, A.K., & Karuppannan, S. (2020). Application of Geospatial Technologies in the COVID-19 Fight of Ghana. *Transactions of the Indian National Academy of Engineering*, 1 - 12.

Tang, W., Liao, H., Marley, G., Wang, Z., Cheng, W., Wu, D., & Yu, R. (2020). The Changing Patterns of Coronavirus Disease 2019 (COVID-19) in China: A Tempogeographic Analysis of the Severe Acute Respiratory Syndrome Coronavirus 2 Epidemic. *Clinical Infectious Diseases*. https://doi.org/10.1093/cid/ciaa423

WHO (World Health Organization). 2020. Coronavirus disease (COVID-19) situation reports. Accessed 12 July 2020.

WHO (World Health Organization). 2020. WHO Coronavirus Disease (COVID-19) Dashboard. Accessed 18 July 2020.

Xie, X., Naminse, E. Y., Liu, S., & Yi, Q. (2020). The spatial and temporal pattern of COVID-19 and its effect on humans' development in China. *Global Journal of Environmental Science and Management*, *6*(Special Issue (Covid-19)), 107–118. https://doi.org/10.22034/GJESM.2019.06.SI.10

Yang, W., Deng, M., Li, C., & Huang, J. (2020). Spatio-temporal patterns of the 2019-ncov epidemic at the county level in hubei province, china. *International Journal of Environmental Research and Public Health*, *17*(7). https://doi.org/10.3390/ijerph17072563

Zhu, N., Zhang, D., Wang, W., Li, X., Yang, B., Song, J., … Tan, W. (2020). A novel coronavirus from patients with pneumonia in China, 2019. *New England Journal of Medicine*, *382*(8), 727–733. https://doi.org/10.1056/NEJMoa2001017