The spread of COVID-19 in the context of regional geography

Jiranya Duangfoo[1] and Pathana Rachavong[2]

[1] Geographic Information Sciences, Naresuan University
[2]Thailand Geographical Association, Email: pathanar@gmail.com
Email: jiranyad63@nu.ac.th

ABSTRACT

The spread of COVID-19 in the context of regional geography aims to study the spatial patterns of the global COVID-19 outbreak situation. We collect data from the World Health Organization and Worldmeter website, the data obtained is the highest cumulative infection and the date of the highest number of countries with more than 10,000 infected cases with 80 countries in total, the data was divided into 14-day intervals for the COVID-19 outbreak. In addition, the outbreak zones are divided into 6 longitude - zones and 4 latitude - zones. The descriptive statistical methods are used to analysis. We discover that it was spread from the early Eastern Hemisphere countries to the countries in the Western Hemisphere at a later time. It was also found that It has spread from tropical regions to warmer regions.

1. INTRODUCTION

Over the past few decades, there have been ongoing outbreaks of serious emerging infectious diseases, such as Severe Acute Respiratory Syndrome (SARS), which have spread over the course of the year 2002-2003. SARS began to spread from China and spread throughout the world. More than 8,000 people have been infected with a 10% death rate. Middle East Respiratory Syndrome (MERS: Middle East Respiratory syndrome (MERS), which is an epidemic in Middle Eastern countries especially Saudi Arabia, infects more than 2,000 people, with a death rate of 35 percent.

The coronavirus disease 2019 outbreak started in China. It originated in a seafood market in Wuhan, the capital city of Hubei Province and was a hub for transportation to several major cities in the People's Republic of China. The first group of infected people were workers and customers of the Huanan Seafood Wholesale Market. Later, on March 11, 2020, the World Health Organization declared the novel coronavirus disease 2019 a pandemic. The number of deaths increased rapidly. The current mortality rate from the disease is about 5.1%. The majority of patients with severe symptoms are the elderly and people with underlying medical conditions such as heart disease and diabetes.

In the first phase of the outbreak in January There are 9,837 cases worldwide, 214 deaths, and 186 recoveries. The country with the most cumulative infections is China. There are a total of 9,692 infected people. In February, the outbreak spread to neighboring countries and the epidemic in China has accumulated 85,403 cases worldwide and 2,924 deaths. In March to April, the outbreak began to spread to Asia. Middle East and Europe, with a total of 750,890 infections worldwide in March and 36,405 deaths. During May, the outbreak hit Europe and began spreading to the Americas, with 5,934,936 infections and 367,166 deaths. Later in June, Covid-19 began to spread to South America and Russia, with 10,185,374 cases worldwide and 503,862 deaths. In July-August, many countries started having 2nd and 3rd rounds such as Japan, Australia, Singapore, and India.

The objective of this research is to study the spatial pattern of the global COVID-19 outbreak to provide spatial data on the spread of COVID-19 for infection prevention and control.

2. METHODOLOGY

2.1 Data Collection and Management

This study compiled data from the World Health Organization and the worldmeters.info website. The information obtained is the cumulative number of infected people and the maximum number of infected people. In the data collection, the period during the COVID-19 outbreak was divided into 14 days of infection. In addition, the epidemic zone is divided into 6 zones according to longitude and 4 zones according to latitude. Descriptive statistics were then used to analyze the distribution and present the data by displaying the number of cases of each country broken down by time and region to reveal outbreak patterns in the context of regional geography. The results of the data analysis were then displayed on the choropleth map to show the distribution patterns of the infected in a given time period and region.

3. RESULT AND DISCUSSION

In the study of the spread of COVID-19 in the context of regional geography, it is divided into two parts: the world time zone region and the global climate region. The research results are as follows.

3.1 Spread of COVID-19 by region, world time zone

The spread of COVID-19 by region is divided into six epidemic zones, 60 degrees each, from the east end to the west.

The results showed that there were a total of 42,857,292 cumulative cases, located in zones 2-6, 14.583 percent, 7.914, 8.602, 11.232 and 0.524, respectively. All of these infections were from the outbreak between February 12 and September 30. The highest number of infected people in each zone were in zones 2 and 5, 156,000 and 147,000, respectively, as shown in Table 1.

The COVID-19 outbreak in Zone 2 has the highest number of cases, totaling 156,000. The highest-infected country is the United States, with the highest number of infections, with 78,763 as of June 24.Argentina had the highest number of cases of 12,701 cases as of September 17, and Peru had the highest number of cases of 10,143 as of August 16.

As for the COVID-19 outbreak in zone 3, the number of confirmed cases is 97,000, with Brazil having the highest number of cases at 70,869 on 29 July and Spain with the highest number of cases at 70,869. The highest number of confirmed cases was 10,854 as of March 20.

For the COVID-19 outbreak in Zone 4, the highest number of confirmed cases totaled 108,000. The country with the highest number of infections was South Africa. The highest number of cases were 13,944 as of July 24, and France had the highest number of cases of 13,498 as of September 19.

While the COVID-19 outbreak in Zone 5 has the highest number of cases totaling 147,000, the country with the highest number of infections is India. The highest number of cases were 97,859 as of September 11, China's highest number of cases was 14,108 as of February 12, and Russia's highest number of cases was 11,656 as of May 11.

And the COVID-19 outbreak in zone 6 has the highest total number of cases of 11,000. The country with the highest infection is the Philippines. The highest number of cases were 6,871 as of August 10, and Japan recorded the highest number of cases at 1,998 as of August 3.

It can be seen that the COVID-19 disease that first emerged at the Huanan Seafood Wholesale Market in Wuhan, Hubei Province, People's Republic of China since the end of 2019. There was a heavy outbreak in the province during February-March and spread to surrounding countries, most notably Japan, South Korea, Hong Kong, Singapore and Thailand, all of which are in zone 5 according to Table 1. Then, into April-May, the outbreak spread westward into zones 4 and 3, the Middle East and Europe, with the worst outbreak countries including Iran, Italy, France, Germany and the United Kingdom. And by the time of June to August, there has been another outbreak spreading to the west. by crossing the Atlantic Ocean into North and South America This is in zone 2 with the highest outbreaks in the United States, Canada, Brazil and Peru. Meanwhile, the countries in zones 5 and 4 also started a second round of outbreaks, namely the People's Republic of China, Iran, Japan and South Korea.

3.2 Spread of COVID-19 divided by global climate zone

In the study of the COVID-19 epidemic by region, the global climate zone was organized into four zones based on latitude, 32 degrees each, counting from the northernmost 84 degrees north to the southernmost 80. degrees south, which each zone has a different climate.

The results showed that a total of 42,857,292 cumulative cases were found in zones 1-4, 26.169 percent, 9.329, 2.367 and 5.103, respectively. All of these infections were from the outbreak between February 12 and September 30, with the highest number of infections in each zone were in Zones 1 and 2, with 301,000 and 134,000 cases respectively, as shown in Table 2.

The COVID-19 outbreak in Zone 1 has the highest number of cases totaling 301,000. The country with the highest number of infections is India. The highest number of cases were 97,859 as of September 11. The United States had the highest number of cases of 78,763 as of June 24. China had the highest number of cases 14,108 as of February 12. France had the highest number of cases of 13,498 as of 19. September and Spain recorded the highest number of cases of 10,854 as of March 20. The COVID-19 outbreak in Zone 2 had the highest total number of cases, totaling 134,000. The highest number of cases were 70,869 as of July 29. Colombia had the highest number of cases at 13,056 on August 19, and Peru had the highest confirmed cases of 10,143 as of August 16.

For the Covid-19 outbreak in Zone 3, the highest number of infected people totaled 36,000. The country with the highest number of infections is South Africa. The highest number of cases were 13,944 as of July 24 and Argentina. The highest number of cases were 12,701 as of September 17, while the COVID-19 outbreak in Zone 4 had the highest total number of cases totaling 50,000. The highest number of cases were 11,656 as of May 11 and the United Kingdom. The highest number of confirmed cases was 7,860 as of April 10.

It can be seen that the Covid-19 epidemic was severe in the People's Republic of China throughout February - May and has spread to surrounding countries. Importantly, India, Iran, Italy and Spain, all of which are in Zone 1, according to Table 2. Then, when entering April-May, the outbreak spread northward to Zone 4 with countries with outbreaks. hard consists of Russia and United Kingdom And when it enters August - September, it has spread to the south into South America and Australia. These are in zones 2 and 3, with outbreaks predominantly

in Brazil, Peru, Chile, South Africa and Australia. Meanwhile, countries in zone 1 have begun to have outbreaks.

Table 1. The spread of COVID-19 in the context of regional geography – by time zone.

	Cumulative number of infected people (milion)	Maximum number of infected people	The date of maximum number of infected people	Time of the outbreak (14 Days)
				1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Longitude 2	14.583	0.156	24 April - 17 September	⑫ ⑮
Longitude 3	7.914	0.097	10 April - 18 September	⑤ ⑥
Longitude 4	8.602	0.108	20 March - 30 September	⑤ ⑥ ⑭ ⑮
Longitude 5	11.232	0.148	12 February - 21 September	❷ ⑨ ⑮
Longitude 6	0.524	0.011	3 March - 10 August	⑬

Table 2. The spread of COVID-19 in the context of regional geography – by climate zone.

	Cumulative number of infected people (milion)	Maximum number of infected people	The date of maximum number of infected people	Time of the outbreak (14 Days)
				1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Latitude 1	26.169	0.301	12 February - 19 September	❷ ⑤ ⑬ ⑭ ⑮
Latitude 2	9.329	0.134	29 July - 16 August	⑬ ⑭
Latitude 3	2.367	0.036	24 July - 17 September	⑭ ⑮
Latitude 4	5.103	0.05	10 April – 30 September	⑦ ⑨

4. CONCLUSION

In the study of the spread of COVID-19 in the context of regional geography by time zone The study managed to divide the epidemic area into 6 zones according to the longitude zone 60 degrees from the eastern end to the western end.

The study shows that COVID-19 first emerged in the People's Republic of China since the end of 2019 and spread heavily throughout February-March and has spread to surrounding countries. When entering April - May, there has been an outbreak spreading to the west. Entering June-August, the outbreak spread further westward, crossing the Atlantic Ocean into North and South America. It can be concluded that COVID-19 has spread from countries in the Eastern Hemisphere in the early stages to countries in the Western Hemisphere later.

In the study of the COVID-19 outbreak, in the context of geographic regions divided by climate zones, the epidemic zone was organized into four zones, each 32 degrees latitude, from 84 degrees north to the north. southernmost 80 degrees south. Each zone has different weather conditions. The study shows that the outbreak of COVID-19 began in the People's Republic of China during February-May and has spread to surrounding countries located in Zone 1. Then

in April - May, the outbreak spread north to the zone 4 and into the August - September outbreak spread south into South America and Australia, which are in the zone. 2 and 3 conclude that COVID-19 has spread from tropical regions to temperate regions.

5. REFERENCES

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