

Factors Contributing to the Number of Covid-19 Cases in Malaysia

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Abstract

COVID-19 is an infectious disease respiratory acute coronavirus syndrome. Malaysia had 4,201,919 total cases as of March 31, 2022, with Selangor having the highest number of cases (10,735). Despite the government's efforts, the highly contagious disease has affected people from all walks of life, and the number of daily cases continues to increase. The objective of this study is to identify the factors that are significantly associated with the daily total COVID-19 cases. The variables that were tested using Negative Binomial Regression were mass testing, vaccination, temperature, and Movement Control Order (MCO). As the result, all predictor variables—except for vaccination—are significantly associated to the number of COVID-19 cases. From this study, the policymakers can utilize the research's findings to identify the variables that influence the number of COVID-19 cases on a day when the number is very high or low, or when the number is constant for a while before a shift in trend occurs.

Keywords: COVID-19, Negative Binomial Regression

Introduction

Since late 2019, the novel coronavirus disease (COVID-19) that was first identified in Wuhan, China has actively spread to Mainland China and throughout the world. Numerous people died, and the spread of infection is still widespread. COVID-19 disease is an infectious disease caused by severe respiratory acute coronavirussyndrome. On March 11, 2020, the contagious disease was declared a pandemic by the World Health Organization (WHO) and, as of March 2022, more than 420 million cumulative cases have been recorded. In the last few decades, Malaysia has had a history of dealing with disease outbreaks and the COVID-19 pandemic is the greatest disease outbreak Malaysia has faced, which has resulted in 34,983 deaths to date with a cumulative case of 4,201,919 as of March 31, 2022 (Hirschmann, 2022). For

comparison, the Nipah virus has taken 105 lives, and 2 lives were lost during the SARS outbreak. Based on COVIDNOW, the confirmed COVID-19 cases in Selangor have been increasing from March 18, 2022, to March 31, 2022. The total daily cases on March 18, 2022, and March 31, 2022, were 7,430 and 10,735 respectively. The rise in the number of COVID-19 cases has also led to an overwhelmed healthcare system. Healthcare workers are overwhelmed with the increasing number of patients requiring treatment, not just for COVID-19 but also including other types of illnesses. With the number of new patients increasing, hospitals are struggling to cope with the basic facilities such as beds and lack the manpower to attend to the patients. The healthcare worker is also struggling with burnout due to the increased workload and is exposed to the risk of being infected with COVID-19. The increase in the number of COVID-19 cases has affected the conveniences of many. Hence, it is important to investigate the relationship between the COVID-19 cases and the possible associated factors contributing to the number of COVID-19 cases.

To control the spread of the COVID-19 infection, many countries have adopted a mass testing approach. Mass testing is described as a substantial number of SARS-CoV-2 tests conducted on individuals in each population, regardless of whether they are exhibiting COVID-19 symptoms. This is done to identify patients that have an active infection and give guidance on intervention strategies. Mass testing proponents claim that it is a cost-effective policy for identifying and quarantining possibly contagious people. As a result, the number of cases and the speed of the disease spread would be reduced (Pavelka et al., 2021). In Iran, the number of cases accelerated after mass testing. Changes in the number and percentage of confirmed cases, recovered cases, and deaths were investigated at the end of six weeks after the mass screening. As a differential from the expected (baseline or counterfactual), the observed results were an increase of 27.0% of confirmed cases (Soodejani et al., 2020). After a mass screening program in Saudi Arabia, the number of confirmed COVID-19 cases increased (Khan et al., 2021). Balila (2020) found that the significant increase in the number of tests resulted in a significant increase in the identified number of infected cases. This shows that mass screening helps in detecting and allocating positive cases better. These findings suggest that mass testing or mass screening may have had a direct contribution to the number of COVID-19 cases. By conducting mass screening, the number of positive cases will increase. Hence, the transmission from asymptomatic COVID-19 patients can be controlled and eventually reduce the number of COVID-19 cases.

Vaccination is one of the means for the prevention and treatment of COVID-19 infection and is defined as the process of giving vaccines to the body to protect against certain illnesses. In a case study in the United States by Roghani (2021), the vaccination eligibility rollout amongst Tennesseans is based solely on their age. Hence, the vaccination rollout is done according to the age-based phases simultaneously with those people in the category of high-risk health conditions. The results of the study show that the daily cases for all age groups decreased inevitably after the onset of vaccination. The daily cases among younger age groups of the total population dropped from 0.2% to less than 0.05% starting from the end of January to the end of the study period during the first 78 days of vaccination in Tennessee. The percentage decrease in the number of daily cases is higher for the older people category in the same period, ranging from 0.1% to nearly 0.01% of daily cases. Another study by Wise (2021), found that the number of COVID-19 infections dropped by two-thirds in England during the vaccination program between mid-January and mid-February. However, Wise (2021) suggests that the case number may not be a well-founded benchmark on whether the vaccine helps in reducing COVID-19 cases in the UK. Meanwhile, in New York, a study has been conducted

regarding new COVID-19 cases among adults by their vaccination status between May 3 and July 25, 2021. The findings revealed that there were 9,664 new cases (1.31 per 100,000 person-days) among fully vaccinated adults compared to 42,507 (9.80 per 100,000 person-days) among unvaccinated adults (Rosenberg et al., 2021).

The transmission of corona viruses can be affected by several factors, including the climate (Tobías & Molina, 2020). As previous research has shown, airborne pathogens are partially subjected to ambient environmental factors, such as atmospheric pollutants, relative humidity (RH), temperature, and Solar Radiation (SR) (Suhaimi et al., 2020). This virus, such as COVID-19, could bind to air particles. Thus, this condition helps them to remain airborne longer and enables them to reach the lungs, causing severe respiratory symptoms, increasing health complications and even leading to fatality (Suhaimi et al., 2020). The rapid spread of COVID-19 infection reported in many nations throughout the world might be attributed to years of exposure to poor air quality, which deteriorates the health of the population in affected regions over time. A finding based on a past study in Pakistan has revealed that there is a relationship between temperature and COVID-19 transmissibility. Low-temperature provinces were discovered to have high links between temperature and COVID-19 transmissibility. Irfan (2021) concluded in his study that the number of COVID-19 cases tends to increase as the temperature decreases.

The Movement Control Order (MCO) refers to the Prevention and Control of Infectious Diseases (Declaration of Infected Local Areas) Order 2020, which was issued by the Malaysian Prime Minister, Tan Sri Muhyiddin Yassin. MCO is synonymous with partial lockdown as it prohibits mass movement and travel abroad for Malaysians, restrictions on foreigners' entry into Malaysia, closing schools, and closure of public and private higher education and all government and private premises. According to Bernama (2020) the MCO saw progressively more stringent enforcement with roadblocks established across the country and the military forces mobilised to enhance MCO enforcement. However, based on the downward trends in the number of new and ongoing Covid-19 cases, it is feasible to conclude that the MCO was effective, given that compliance with the MCO is maintained. Furthermore, several versions of the Conditional Movement Control Order (CMCO) were introduced in Malaysia in the first month of October in various states, namely in Sabah, Selangor, and WP Kuala Lumpur (Pang et al., 2021). After a period where the pandemic spread appeared to have been quelled, the free movement was reinstated throughout the country in December 2020, during the year-end holidays, causing a high amount of movement between states that had higher and lower infectivity (Pang et al., 2021). Yong & Sia (2021), in his studies, claims the increase in positive cases in Malaysia from September 2020 to April 2021 is due to the failure to follow SOPs during the Sabah state election and the large assembly allowed during the MCO for various events. Lastly, Malaysia has introduced a variety of steps to prevent the COVID-19 epidemic, culminating in the accomplishment of the MCO (Tang, 2020).

Methodology

Description of Data

The study was conducted using secondary data. Five variables are covered in this study, which are the daily total COVID-19 cases, the number of mass testing, the number of daily vaccinations, the daily average temperature, and Malaysia Movement Control Order implementation. The data for variables such as the number of cases, the number of mass testing, and daily vaccination is obtained from GitHub. GitHub is a reliable website known as a repository hosting service. The detailed information about the banning of interstate travel

during MCO is collected from the MKN website, while the recorded data on the temperature in Selangor is collected from the time and date website. Selangor has been chosen as the research population in this study. The observations of this study were done from January 25, 2020, to March 31, 2022.

Research Framework

In this study, the number of COVID-19 cases in Selangor is the dependent variable, while the independent variables were mass testing, vaccination, temperature, and movement control order (MCO). For the mass testing, the data was taken daily and refers to the number of tests done using RTK-Ag (Antigen Rapid Test Kit) and RT-PCR (Reverse Transcription-Polymerase Chain Reaction). Data for temperature is taken from an average temperature per day. For MCO, 1 (Yes) if there was a ban on interstate travel and 0 (No) if there was no ban on interstate travel. Variables for vaccination refer to the sum of individuals that are fully and partially vaccinated for each day. Finally, the data recorded for the dependent variables were the number of cases reported in the previous 24 hours since the last report.

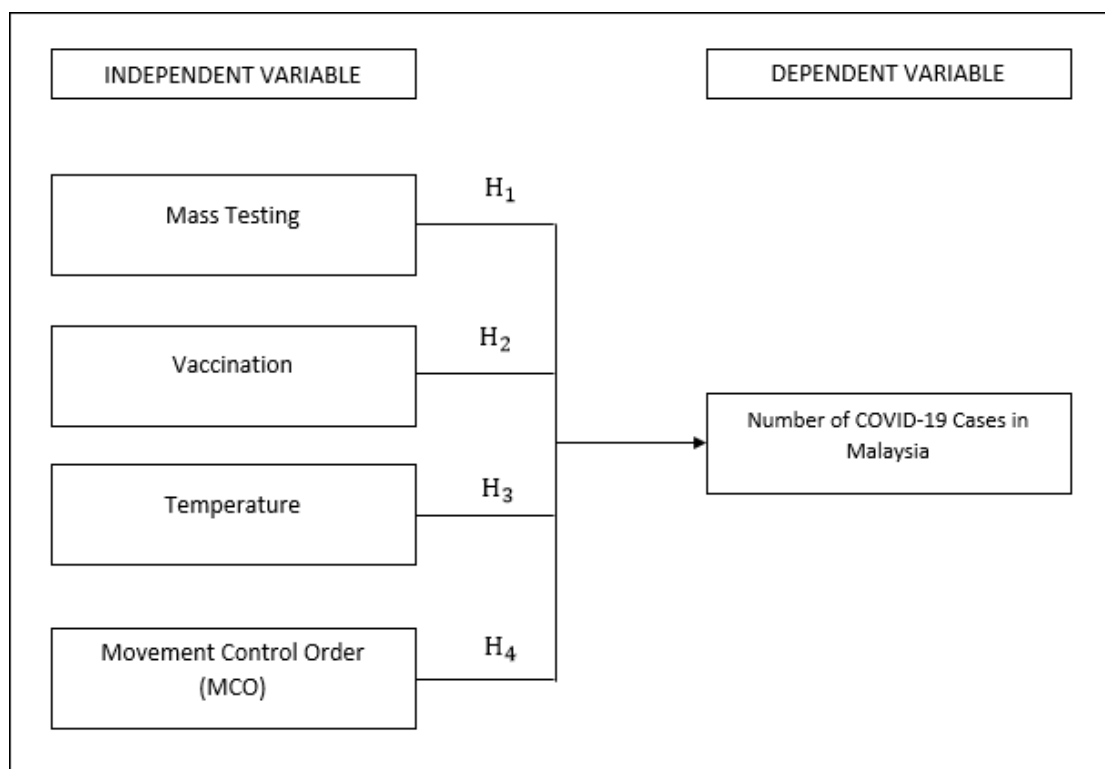


Figure 1: Research Framework

Negative Binomial Regression Analysis

Poisson regression is frequently employed to characterize count data. There are five assumptions to be met before carrying out this method which are firstly the dependent variable consist of count data. The data also must have more than one or two independent variables. Next, the observations are independent of the other observations. The distribution of a count which is dependent variable must follow Poisson distribution model and lastly the mean and the variance of the model should be equal (equidispersion). However, the distribution of the count data usually has unequal variances and mean, with overdispersion as the most common issue and underdispersion being one of the uncommon cases. Hence, negative binomial regression is one of the approaches to address this issue. Negative binomial

distribution is used to model count data with overdispersion problem. As the dispersion parameter increases, the variance converges to the mean's value, turning the negative binomial distribution into a Poisson distribution. This method is used to fulfil the objective which is to identify factors that are significantly associated with the daily total COVID-19 cases. The significance of the independent variables is determined by the p-value. A variable is significant if it has a p-value less than 0.05.

Incidence Rate Ratio

Incidence Rate Ratio (IRR) referred as relative risk is the probability of an event occurring in the exposed group divided by the probability of the event occurring in the non-exposed group. IRR value can be obtained by exponentiating the Negative Binomial Regression coefficient. Relative risk with value greater than one implies that the event is more likely to happen if there was exposure. A relative risk of one implies there is no difference of the event if the exposure has or has not happened. Lastly, relative risk with value less than one implies that the event is less likely to happen if there was exposure.

Results and Discussions

Assessing the Model Fits and Overdispersion

The goodness-of-fit of the poisson model is shown in Table 1. The goodness-of-fit chi-squared test is statistically significant with a p-value of 0. As a result, the data does not appear to fit the model well.

Table 1

Chi-Squared Goodness-of-Fit

| Residual Deviance | df | Sig. |
|-------------------|-----|------|
| 810152 | 792 | 0 |

Since the data did not fit the model well, an overdispersion test was performed to assess if the poisson regression model's assumptions were violated. To assess the overdispersion, the residual deviance to the degree of freedom is calculated.

Table 2

Assessing Dispersion

| Residual Deviance | df | Dispersion |
|-------------------|-----|------------|
| 810152 | 792 | 1022.919 |

The result in Table 2 is 1022.919, which is more than one. This demonstrates that the model is overdispersed, which contradicts the poisson regression assumption. As a result of the model's poor fit and overdispersion issue, poisson regression analysis cannot be applied. Therefore, negative binomial regression is conducted to overcome the overdispersion problem of the count data.

Improvement for Overdispersion Model

According to the result obtained in Table 3, when all the independent variables are zero, the log number of COVID-19 cases is 8.533. Only three predictor variables, mass testing, temperature, and MCO are significantly associated to the number of COVID-19 cases in Selangor. It may be inferred that vaccination had no influence on the number of COVID-19

cases as the p-value = 0.172 is greater than 0.05. This result is consistent with previous research by Wise (2021), suggesting that the case number is not a good benchmark of whether the vaccine reduces COVID-19 cases. This is because, while vaccination can assist to reduce the severity of COVID-19 infection, it does not guarantee that a person will not become infected with COVID-19.

Table 3
Parameter Estimates

| Parameters | Estimated Coefficient | Std Error | p-value |
|--------------|-------------------------|------------------------|---------|
| Constant | 8.533 | 2.178 | <0.001 |
| Vaccination | -3.231×10^{-6} | 2.365×10^{-6} | 0.172 |
| Mass Testing | 9.710×10^{-5} | 3.742×10^{-6} | <0.001 |
| Temperature | -0.0614 | 0.0262 | 0.019 |
| MCO | 2.867 | 0.1252 | <0.001 |

The IRR (relative risk) are equal to the exponents of the coefficients. According to Table 4, the relative risk value of vaccination is 1.00, suggest that there is little difference in the number of COVID-19 cases for every single unit increase in daily vaccination. However, because the p-value was greater than 0.05, the negative binomial regression test concluded that vaccination is not significantly associated to the number of COVID-19 cases in Selangor. Following that, mass testing also has an IRR of 1.00, which means that for every one unit increment in mass testing, the number of COVID-19 cases will also increase by 1.00 times. Temperature has an exponentiated coefficient of 0.94, this means that the number of COVID-19 cases will decrease by 0.94 times for every unit increase in temperature. Finally, assuming all other factors remain constant, if interstate travel is prohibited during MCO instead of not being prohibited, the number of COVID-19 cases will increase by 17.58 times.

Table 4
Incidence Rate Ratios (IRR)

| Parameters | Incidence Rate Ratios (IRR) |
|--------------|-----------------------------|
| Constant | 5081.72 |
| Vaccination | 1.00 |
| Mass Testing | 1.00 |
| Temperature | 0.94 |
| MCO | 17.58 |

Conclusion

By studying the factors that are significantly associated with the daily total COVID-19 cases in Selangor, this research has highlighted the factors that may be the cause of the increase and decrease number of daily cases. To review, the research has shown that factors like mass testing, temperature, and MCO are significantly associated with the daily total COVID-19 cases in Selangor. This study shows that mass testing had a positive effect on the number of COVID-19 cases. Moreover, the number of COVID-19 cases will decrease by 0.94 times for every unit increase in temperature as shown in Table 5. Next, this study found that MCO implementation is significantly associated with the daily total COVID-19 cases in Selangor.

Table 5

Summary of Results

| Parameters | p-value | Incidence Rate Ratios (IRR) |
|--------------|---------|-----------------------------|
| Constant | <0.001 | 5081.72 |
| Vaccination | 0.172 | 1.00 |
| Mass Testing | <0.001 | 1.00 |
| Temperature | 0.019 | 0.94 |
| MCO | <0.001 | 17.58 |

The study has also given a result of vaccination having no impact on the daily total COVID-19 cases in Selangor as the p-value is more than 0.05. This result may come into shocked for some and one may lead to think that vaccination is unnecessary in containing the number of COVID-19 cases, but the vaccination purpose is to build resistance to specific infections and makes immune system stronger using body's natural defenses.

This topic is an interesting point to investigate. It is essential to conduct this study thoroughly because it will assist the government in making changes to the country's economy to mitigate the effects of COVID-19 and to cutdown the number of COVID-19 cases. This study serves as an excellent guideline and reference for future research. For the best results, future researchers should include more dates of daily total COVID-19 cases until the most recent date.

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