

Analyzing the Covid-19 Cases in Malaysia during the Transition to Endemic Phase

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Received: 27 Oct 2022

Accepted: 8 Sept 2023

ABSTRACT

Coronavirus disease (Covid-19) has contagiously hit the world since December 2019. Once the virus started spreading in Malaysia, people were very conscious of the virus infection and transmission which may cause of death. At the same time, the new cases were being highlighted daily through news in all social media sites. However, during the transition to endemic phase started on April 1, 2022, people were less concerned, and some even lost interest in knowing the Covid-19 news and cases. The aim of this study is to differentiate the pattern of daily cases and deaths of Covid-19 disease during the pandemic phase and the endemic phase. This study also attempts to observe the expected spreading pattern of Covid-19 starting from the first day of the endemic phase using SEIR Model. The data for this study were gathered from November 1, 2021, to March 31, 2022, and from April 1, 2022, to August 31, 2022, to represent the pandemic phase and the endemic phase, respectively. The findings show that the average of daily infection cases and deaths decreased about 67% and 80%, respectively from the pandemic phase to the endemic phase. Based on the SEIR model for the transition to endemic phase, the spreading was at peak around the middle of April 2022 and then, it stabilized by the end of June 2022. Since the existing model only deals with reported cases, it is highly recommended to include the unreported cases as a new variable of interest for the extension of this study.

Keywords: Covid-19, Endemic phase, SEIR Model.

1 INTRODUCTION

The coronavirus (Covid-19) infection, a new potentially fatal disease, has struck the global community. This outbreak began in the Hunan wholesale seafood market in Wuhan, China, which commonly sold and traded live animals such as bats and frogs [1]. This virus has spread all over the world, including Malaysia.

In Malaysia, many effective actions have been implemented to control the spread of Covid-19 virus to the community. Malaysian government had announced the Movement Control Order (MCO) as

the first step to prevent the transmission of Covid-19 spike in the country due to the higher number of positive cases and the difficulties in tracking the contacts [2]. Quarantines, travel restrictions, and the closure of venues such as schools, companies, or shopping malls have been imposed for keeping social distancing. Malaysians were strictly advised to stay indoors. They were restricted from being involved in large gatherings but were urged to do a health screening for those who came back from abroad. Furthermore, the travelers were forbidden from entering Malaysia and all facilities were closed except for essential services. Social and physical distancing strategies have been implemented to restrict the spread of disease by interrupting Covid-19 transmission networks and preventing the emergence of new ones. These social separation and movement restriction techniques have reduced the illness transmission [3].

The MCO has been extended numerous times, each with its own set of standard operating procedures. Economic, tourist and educational sectors were closed during the MCO because close contact needed to be avoided between citizens. This approach was very effective in controlling the spread of viruses, but it also had negative impacts for many people. Some were jobless and stressed. The Covid-19 not only has posed a clear and present danger to people's health, but it has also changed how people survive, work, study, and operate in practically every part of the world [4].

When the pandemic first hit Malaysia, people were excited to know about the statistics of daily positive cases as well as the daily total number of deaths in social media. Consequently, the government has created an application, known as *MySejahtera*, gathers all information related to Covid-19 and updates the cases daily for the users' information. Hence, people were eager to see the update on the application every day. As a result of the high number of daily incidents, people are increasingly agitated because it intends to continue the quarantine order. People also have avoided the places or activities which have high cases that could expose them to the Covid-19 virus.

Many restrictions were reduced when Malaysia has come to the transition of endemic phase starting on April 1, 2022. The wearing of face masks has been lifted and made optional for outdoor activities. The face masks are still required for indoor activities, including on public transportations and e-hailing rides. Physical distance is only recommended when masks are not worn. In addition, mandatory QR code scanning using the *MySejahtera* mobile application and vaccination status checking before accessing the premises have been eliminated. For fully vaccinated travelers, no pre-departure or on-arrival Covid-19 tests are required [5]. These loosening of restrictions make people less worried. Some of them no longer even care about the daily positive cases and deaths although the cases are still around them. To keep providing the information and awareness of the virus transmission to the society as well as to any responsive authorities, an analysis on the number of daily positive cases and deaths along with their trends during the transition of endemic phase will be conducted.

2 LITERATURE

The first three imported cases of Covid-19 in Malaysia were reported on January 25, 2020. The imported cases were infections transmitted outside Malaysia by the individuals' travel history [6]. Furthermore, the cases were discovered when the Singapore Ministry of Health received a notice

that eight close contacts of a confirmed case of Chinese nationality in Singapore had travelled to Johor, Malaysia. The three Chinese nationals who had close contact with an infected person in Singapore entered Malaysia via Singapore on January 24, 2020 [7]. Fortunately, since the first wave, there were just 22 positive cases, all of which were successfully discharged [8].

The second outbreak wave began on February 27, after 11 days of no reported cases, with an increase to 553 positive cases by March 16, 2020. The wave started in Selangor and expanded to several other states. The second wave of outbreaks came from the largest clustered established from a mass religious gathering at Masjid Sri Petaling in Selangor from February 27 to March 3, 2020, which gathered an estimated 15,000 or more people [9]. The case was first identified when the Brunei Health Government notified the local authority after detecting a first local case of Covid-19 involving an individual who had joined the religious gathering at Sri Petaling Selangor. Following the announcement, governmental agencies did everything possible to track down all Malaysians who had attended the gathering for medical checks. Other research stated that a 53-year-old male who had just returned to Brunei after attending the religious ceremony was verified as the first Covid-19 positive case discovered in Tutong, Brunei [7, 10]. The reported new cases increased from 41 to 190 on March 15, with most cases related to the Sri Petaling religious cluster. Hence, on March 18, a Movement Control Order (MCO) was announced to stop the virus from spreading to other citizens [6].

Many countries suffering from the Covid-19 virus have implemented MCO, best known as social quarantine, to prevent virus infection. The social quarantine, commonly known as lockdowns, is connected to social isolation, and has become an approaching technique in the global control of Covid-19 [6]. On January 23, 2020, Wuhan, China's pandemic hotspot went under lockdown for the first time. When the number of Covid-19 cases rose during the second wave, Malaysia adopted a similar strategy and established a phase 1 MCO from March 18 until March 31, 2020. This was expanded for another two weeks for phase 2 MCO from April 1 to 14, 2020, then for another two weeks for phase 3 MCO from April 15 to 28, 2020, and finally for another two weeks for phase 4 MCO from April 29 to May 12, 2020. As a result, the overall MCO period was fixed at eight weeks. MCO has been implemented to minimize the social contact with people. Danial et al. [11] believed that the main objective of MCO was to achieve social distance. Therefore, all mass gatherings involving religious, recreational, social, and cultural activities were prohibited. However, the essential services were permitted to run with only one member per family and were restricted to purchasing daily essentials. Altahir et al. [12] also stated that since March 18, 2020, all locals have been forbidden from going abroad, and tourists have also been disallowed from crossing the border. Furthermore, the Malaysian Ministry of Higher Education announced that traditional classroom teaching and learning would be turned to online learning until December 2020 [13].

The most promising strategy for controlling the Covid-19 disease is to develop vaccines to prevent SARS-CoV-2 infection. Covid-19 vaccinations are widely available around the world. Malaysia has become one of the countries which developed a vaccination program to protect its citizens from the Covid-19 virus. The Malaysian government obtained the Covid-19 vaccine through a government-to-government agreement with the Republic of China's direct purchase from pharmaceutical companies and the Covid-19 Global Vaccine Access (Covax) Facility [14]. The first batch of Covid-19 vaccinations arrived in Malaysia by February 2021. This study was then supported by Suah et al. [15] who claimed by beginning February 24, 2021, the Covid-19 vaccines were offered in Malaysia through the National Covid-19 Immunisation Programme (*Programme Imunisasi Covid-19 Kebangsaan; PICK*). Through this program, Malaysia has provided three main vaccines, which were

Pfizer (Comirnaty), AstraZeneca (Vaxzevria), and Sinovac (CoronaVac). The vaccines were subsequently accomplished in three phases, with the first phase prioritizing the front-line workers. The second phase later focuses on the high-risk groups, such as the elderly and those with chronic diseases. Finally, the adult population over the age of 18 would be targeted in phase three [16]. To prevent the spread of illnesses, hospitalizations, and death, Malaysia set the goal to have at least 80% of Malaysian adult population get vaccines by February 2022 [17]. Consequently, 78.2% of Malaysians was completely vaccinated in December 2021. Moreover, the booster doses have been used by 4,430,656 of them.

The Covid-19 is one of the illnesses that transmits from a pandemic to an endemic. Covid-19 has not completely disappeared, but its power to destroy communities and the way of life would greatly diminish [18]. The news from *BERNAMA* has revealed that Malaysia will enter the "Transition to Endemic" phase with the reopening of the nation's borders after fighting the Covid-19 pandemic for two years. Malaysians are beginning to resume their normal way of life under the new normal. With the switch to endemicity, limitations previously are put in place to stop the outbreaks of Covid-19 which have now been lifted [19]. The limitations that have been eliminated are for those restricting business hours and physical separation while praying. These limitations were once required to be implemented to stop the spread of Covid-19 [20].

Besides that, the necessary isolation for Covid-19 close contacts has already been removed by the Health Minister of Malaysia [21]. The Health Minister and Education Minister have announced that face mask usage is no longer required for outside activities. Nevertheless, it must still be used indoors. Thus, individuals are only required to practice social distancing while only not wearing masks. Both ministers dropped the requirement to scan a QR code using the *MySejahtera* mobile application and verify one's immunization status before entering a building. However, those who are under a Home Surveillance Order must still proceed to update it in *MySejahtera* [5].

3 METHODOLOGY

3.1 Data Collection

The data on the positive daily cases of Covid-19 infection and the daily cases of death of adult at the aged of more than sixteen years old in Malaysia were obtained from the Official Github account of Malaysia's Ministry of Health (MoH-Malaysia portal (<https://github.com/MoH-Malaysia/covid19-public/tree/main/epidemic>)). Data were taken from November 1, 2021, to March 31, 2022, during the pandemic phase. The data for the transition to endemic phase were collected from April 1, 2022, to August 31, 2022.

3.2 Pattern Analysis

This study aims to analyze Covid-19 cases by comparing the daily positive cases and daily death of Covid-19 during the pandemic and the endemic phases. The data were plotted for both phases using Microsoft Excel.

3.3 SEIR Model Formulation

The Covid-19 virus primarily spreads from one person to another, and it is mostly transmitted through the air in liquid droplets from an infected person's mouth and nose. When the infected person, denoted as Person A, coughs, sneezes, interacts, or even makes physical touching with another person designated as Person B, the infection spreads. The virus can then be spread by Person B to numerous people in the same methods, which will cause a pandemic, as illustrated in Figure 1

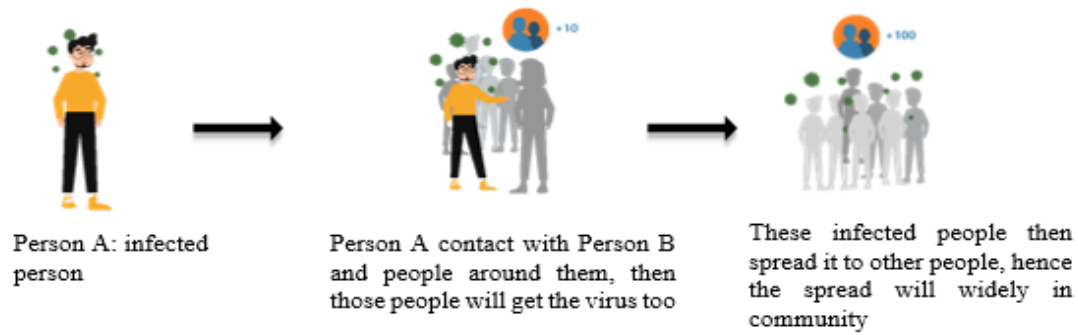


Figure 1: The transmission of the Covid-19 virus

The epidemiology model is used to explain the transmission of Covid-19. The model is divided into four components, namely the susceptible (S), exposed (E), infected (I), and recovered population (R). S indicates people who have chances to be exposed to the disease. E denotes the number of people exposed to the disease or infected but has not yet been contagious. I refers the number of infected individuals who can pass the illness to susceptible people through contact. Finally, R represents the proportion of people who have effectively achieved disease immunity or been eliminated by death. Figure 2 illustrates the transmission of Covid-19 using the SEIR model.

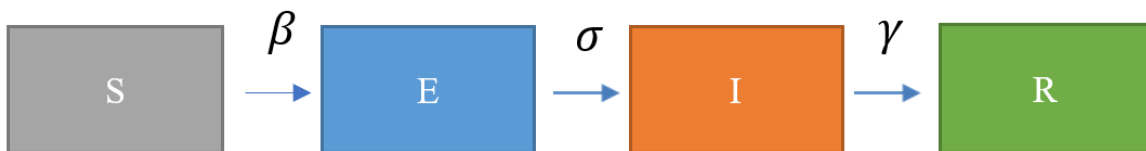


Figure 2: The illustration of the transmission of Covid-19 via the SEIR Model.

In this study, the fixed number of N refers to the total number of adults at the age of more than 16 years, in Malaysia. This total number of the chosen population comprises the four components that are $N(t) = S(t) + E(t) + I(t) + R(t)$. The SEIR model which represents the spread of Covid-19 is governed by [12]:

$$\begin{aligned}\frac{dS}{dt} &= -\frac{\beta SI}{N}, \\ \frac{dE}{dt} &= \frac{\beta SI}{N} - \sigma E, \\ \frac{dI}{dt} &= \sigma E - \gamma I, \\ \frac{dR}{dt} &= \gamma I.\end{aligned}$$

subject to the initial conditions $S(0) > 0$, $E(0) > 0$, $I(0) > 0$, $R(0) > 0$. The model will be solved using Maple software.

4 RESULTS AND DISCUSSION

Figure 3 shows the daily pattern of positive Covid-19 cases throughout the pandemic and the endemic phases. The x-axis represents the date of observation, which comprised from November 1, 2021, till August 31, 2022. The y-axis displays the number of cases for each day of the data collected. The orange line indicates the pandemic phase, which took place from November 1, 2021, to March 31, 2022, while the blue line reflects the pattern for transition to the endemic phase, which lasted from April 1 to August 31, 2022.

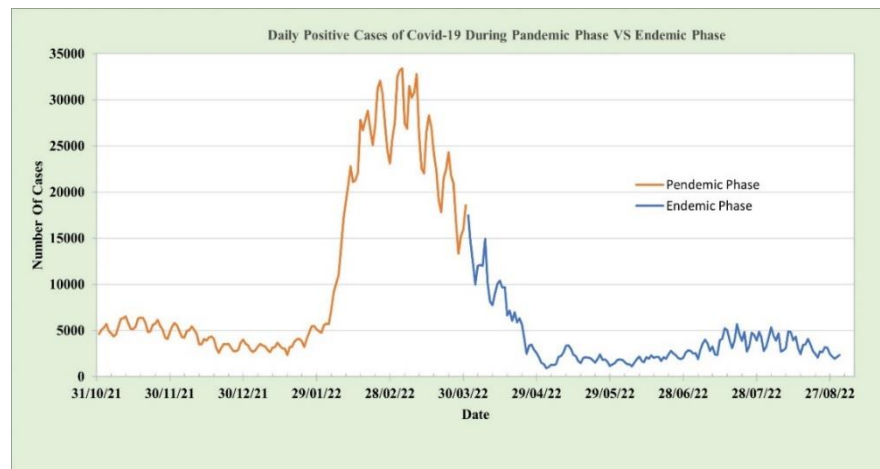


Figure 3: Pattern for daily positive cases of Covid-19 during pandemic and transition to endemic phase

As seen in Figure 3, throughout the pandemic period, the pattern shows a steady fluctuation of less than 10,000 cases over three months from November 2021 to January 2022. The daily average cases from November 2021 to January 2022 were approximately between 3000 and 5000 per day. A probable reason for that pattern is based on Health Ministry's CovidNow portal, Malaysians have received their Covid-19 vaccine booster shots by January 2022, that has increased the total number of booster doses delivered to the adult population in the nation to 42.7%. However, on February 6, 2022, the positive cases began to increase to 10,000 per day, reaching an all-time high of 33 406 on

March 5, 2022. That was the highest daily case count since MCO was loosened up in October 2021. Even though cases were rising, MCO is no longer functional, as are other limitations, such as restrictions to celebrate festival like Chinese New Year [22]. As a result, new cases in Malaysia have been rapidly growing, with the health ministry reporting 11,034 on February 7, 2022. The increase occurred around Chinese New Year, when many Malaysians travel, however, the health officials stated that many patients had minor symptoms [23]. Even then, the number of cases decreased with the pattern drop much more in the middle of March 2022 showing that less people were infected after the celebration.

During the endemic phase, the pattern clearly depicts a positive indicator when the number of cases continued to drop rapidly till it reached less than 5000 cases per day up to August 31, 2022. According to the graph in Figure 3, the number of positive cases on April 4, 2022, was 17 476, but within less than a month, it declined by 77.07%, or 4006. This statistic pleased observers once again when Malaysia finally hit less than 1000 cases per day, resulting in 922 cases on May 3, 2022.

Figure 4 shows the pattern for death of Covid-19 cases throughout the pandemic and the transition to the endemic phase. The x-axis represents the evolution dates, which comprised from November 1, 2021, until August 31, 2022. The y-axis displays the number of death cases for each day of the data collected. The left side indicates the pandemic phase, which took place from November 1, 2021, to March 31, 2022, while the right side reflects the pattern for the endemic phase, which lasted from April 1 to August 31, 2022.

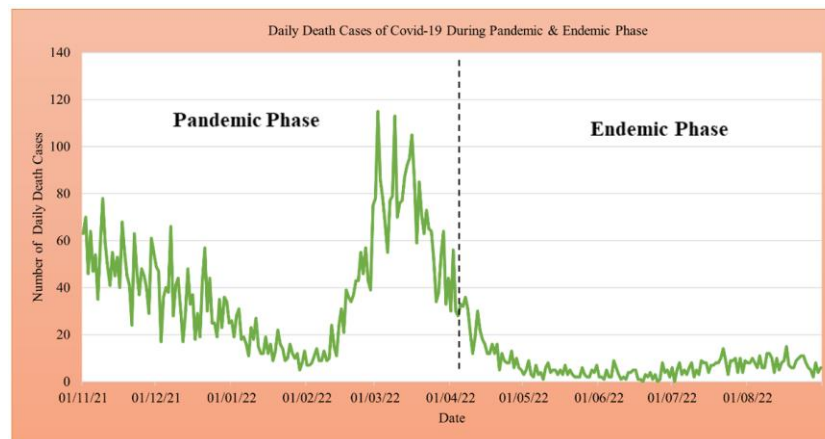


Figure 4: Pattern for daily death cases of Covid-19 during pandemic and transition to endemic phase

Figure 5 reveals that the pattern for the number of deaths is decreasing from November 2021 until January 2022. This is related to the pattern of positive daily cases in Figure 4 when Malaysians who have had their Covid-19 vaccination booster shots till January 2022. They have the protection to protect themselves from serious consequences such as death caused by Covid-19. This is because the research has found that the booster provides a very high level of protection against both moderate and severe illness [24]. Even though booster shot rate in the adult population is significant, this does not guarantee that the death rate cannot be high again. The number of deaths caused by Covid-19 has begun to rise again, with the highest case being 115 per day on March 2, 2022. It was reported that the rate of death due to Covid-19 is higher among aged people, particularly those who

have not received complete vaccines and booster doses [25]. It is because people over the age of 80 have weak immunity, suffer from various chronic diseases, and are weak. Therefore, the healing and recovery process from the Covid-19 infection is slower, becoming critical and finally leading to death [26].

Once the endemic phase began, the death rate dropped below 10-case-per-day at minimum level. This behavior generally tends to happen when the number of cases of infection drops significantly over the endemic period. Malaysian have learned the risks of less concerned about the presence of the Covid-19 virus by following health advice frequently highlighted by the Ministry of Health during the transition to endemic, in addition to the effectiveness of the Covid-19 vaccination programs all over the country.

The overall finding specifies that during the endemic phase, the number of infection and death cases reduced positively compared to pandemic phase. It is proven by the total number of cases during the pandemic period, which covered from November 1, 2021 to March 31, 2022, shows 1730277 positive cases and 6074 deaths. For the endemic phase from April 1, 2022, until August 31, 2022, the accumulative number of positive cases was reduced by 66% (580705) and 80% (1233) for death cases. Based on this total number of cases, it is possible to calculate the average number of daily positive cases and deaths throughout the pandemic phase which were 11459 and 40, respectively. While the transition to endemic phase was 3795 and 8, respectively.

Figure 5 shows the expected distribution of four different components; S, E, I and R using the SEIR model with the initial number for each component as $S(0) = 25000000$, $E(0) = 95406$, $I(0) = 17476$, $R(0) = 17351$ for Covid-19 cases during the transition to endemic phase. The initial date is on April 1, 2022, that is the date of the endemic phase started. The blue line represents Susceptible, the cyan line represents Exposed, the red line represents Infected, and the green line represents Removed.

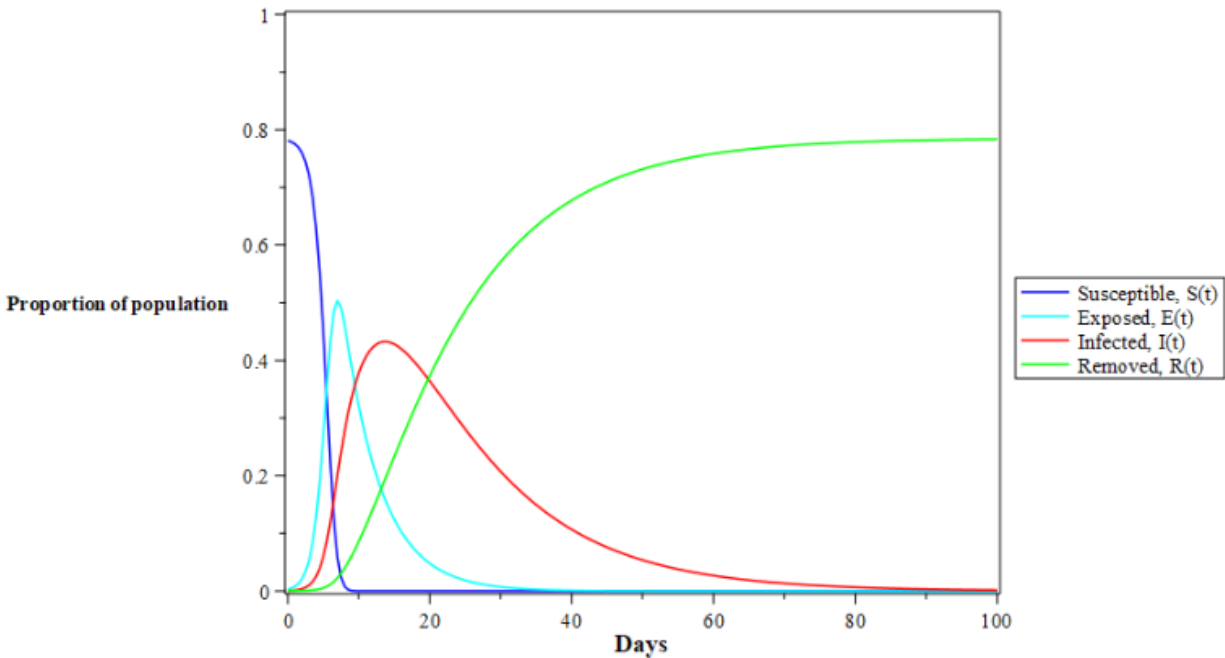


Figure 5: The normalized distribution of four different components in the SEIR Model

The infection period would reach the peak roughly 18 days after April 1, which corresponded to the third week of April (April 19) with the percentage of the population impacted would be around 43%. From April 1, it was expected that new cases will continue to be detected and the outbreak was expected to end around June 30, 2022. It can also be observed that the highest exposed cases would be roughly 9 days after the endemic phase began, with the proportion of the population impacted would be around 50%. In the case of the removed category, 70% of the entire population has been recovered or has died due to the Covid-19 by day 40 and continues to increase until day 100.

5 CONCLUSION

Based on the study of the pattern of the daily positive cases and death cases from the pandemic phase to the endemic phase, the average number of daily infection cases and deaths were reduced 67% (from 11,459 to 3795) and 80% (from 40 to 8), respectively. Further study at the phase of transition to endemic has been done by developing a model to analyze the transmission of Covid-19 cases in the system of four ordinary differential equations known as the SEIR model. The findings show that the positive Covid-19 cases in Malaysia during the endemic phase was peak around the middle of April 2022 and then stabilized by the end of June 2022. This finding is comparable with the study of the daily positive cases pattern and death cases, starting from pandemic phase to the endemic phase. Thus, it shows that the decision to shift the pandemic phase to endemic phase in April 2022 is an appropriate decision.

Although the number of positive cases and the death rates of covid-19 is getting smaller, the virus is still around in which the statistics from April 30 until May 6, 2023, showed that there were 7596 new cases and 7 new deaths. This uncommon occurrence may have been impacted by the reproduction number, R_0 value over this transition to endemic period. The value of R_0 throughout this month was found to be below 1 on average. For R_0 less than 1, the transmission is likely to slow down since one infected person will transmit less than one individual on average [27]. As a logical consequence, the number of people who will become infected with Covid-19 virus will decrease day by day throughout this period. Therefore, everybody in society should have social responsibility and be self-engagement in preventive effort to control the disease. The government is responsible for reviewing and implementing certain policies to accommodate this endemic virus.

The SEIR model has been applied in this study to observe a fixed number of populations. Therefore, for future research, it is recommended to consider a non-fixed population to make it more precise where N can follow a logistic growth model. In addition, the number of reported cases (both confirmed cases and recovered cases) is frequently fewer than the actual number since only the number of adult age more than 16 years old being considered in this study. Thus, to obtain a more accurate outcome, the number of the whole population in Malaysia should be analyzed.

ACKNOWLEDGEMENT

The authors would like to acknowledge Universiti Teknologi MARA Perlis Branch for the financial support. The authors would also like to express their appreciation to the ISTECoSQA 2023 for the opportunity to present this research findings.

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